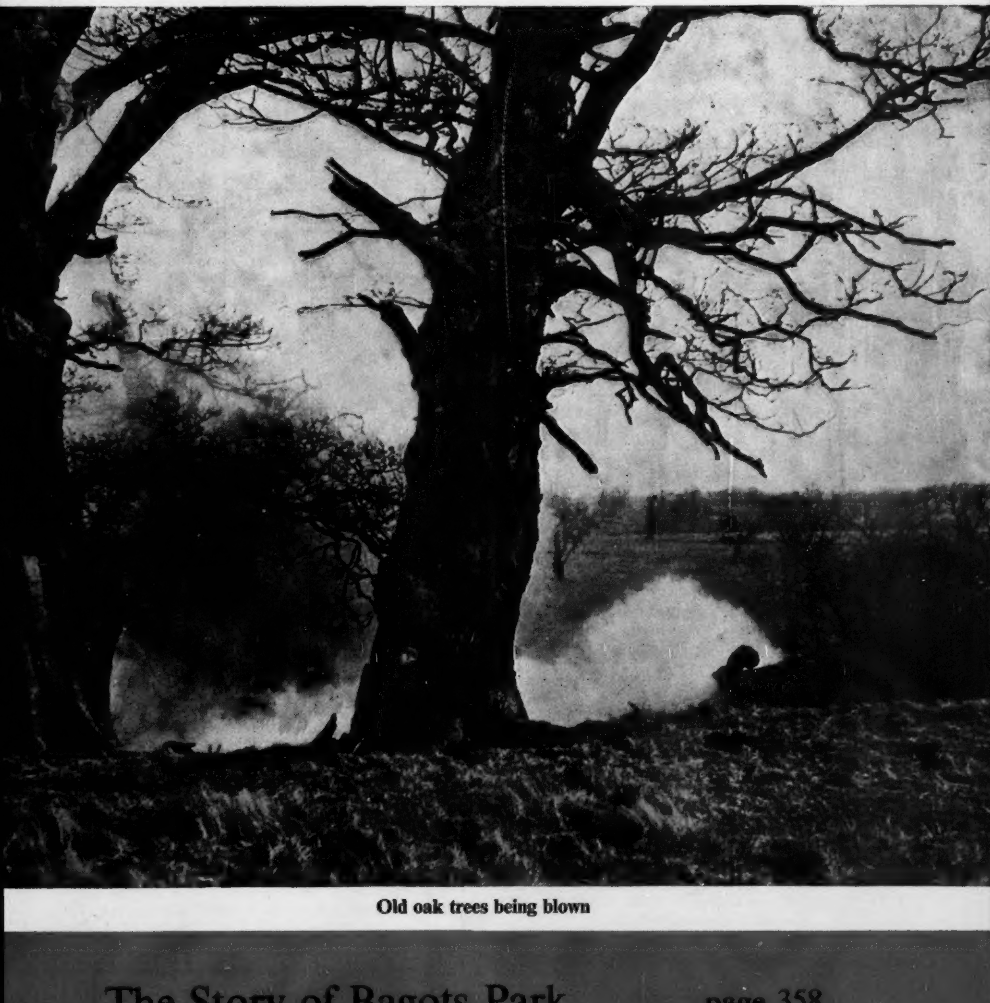
agriculture

Vol. 74 No. 8 August 1967

Published for the Ministry of Agriculture, Fisheries and Food by Her Majesty's Stationery Office

1s. 3d. MONTHLY



Old oak trees being blown

The Story of Bagots Park page 358

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Bags of farming experience

Agriculture

VOLUME 74 · NUMBER 8 · AUGUST 1967

Editorial Offices
Ministry of Agriculture, Fisheries and Food
Whitehall Place, London S.W.1.

Contents

The Royal Lancashire Agricultural Society

WHAT could be more appropriate than that Lammas Day, linked with old time farming as the occasion when the gathering of the first fruits of the land was celebrated with customary ceremony, should this year mark an important anniversary in the story of British agriculture? On 1st August and the two succeeding days, the Royal Lancashire Agricultural Society's annual show at Blackpool was a special event commemorating the bicentenary of the foundation of an organization which gave birth to the oldest show promoting society in the country.

Although the Royal Lancashire Agricultural Society, as such, was only formed in 1893, its forebears had already been in operation for over one and a quarter centuries. The continuity extends back to the brainchild of one Thomas Butterworth Bayley, the Society for the Improvement of Agriculture in the Hundred of Salford, soon afterwards to become the Manchester Agricultural Society, formed as the result of a meeting in the Old Coffee House, St. Ann's Square in the heart of Manchester. Today, of course, the adjoining cities of Salford and Manchester have little real connection with agriculture, but not only was that initial meeting held in the last mentioned city, but the first show, in October of the following year, actually took place in St. Ann's Square, a stone's throw from the Old Coffee House. For over sixty years, the Manchester Society continued its annual shows, although long before that time they had been moved from the original site. But in 1830, Liverpool, not to be outdone, formed a similar organization and promoted shows in the Merseyside area.

An important move came in 1845 when, according to the Society's records, 'the Earl of Derby expressed the wish, with the consent of the inhabitants of Liverpool and Manchester, to unite the Liverpool Society with the Manchester Society'. The Earl's request was carried out and the combined organization became the Manchester and Liverpool Agricultural Society, operating over an area which included Cheshire and parts of Flintshire as

well as Lancashire itself. Meanwhile, agriculturists further north, no doubt feeling somewhat neglected by the emphasis on the southern part of the county, formed the Royal North Lancashire Agricultural Society in 1847, and this continued as a separate organization until 1874 when it was amalgamated with the older one and the new title became the Royal Manchester, Liverpool and North Lancashire Agricultural Society. Such a style, however, was somewhat too cumbersome even for the nineteenth century, and in 1893 came the reconstitution of the society, confining activities to the County Palatine of Lancashire itself and taking on the name which persists today. Although the parts played by the original organizations are often forgotten, they are commemorated in the present crest which incorporates the Royal Arms, granted through the patronage of the reigning monarch, who, of course, is always Duke of Lancashire, and parts of those of Manchester, Liverpool and the county city of Lancaster.

It is, of course, the birth of the original Salford Society that is commemorated in August, and in this the two names that stand out prominently are those of the founder, Thomas Butterworth Bayley, and the first president, Col. Richard Townley, of Belfield, both of which were mentioned in an advertisement that appeared in the *Manchester Mercury and Harrop's General Advertiser* for 4th August, 1767. This called for subscribers of half a guinea upwards to inaugurate premiums for 'such improvements in agriculture within the Hundred of Salford as shall be thought most necessary and of most general use'. So great was the response that only three weeks later a second notice in the same publication read:

> The Gentlemen who proposed to promote (by Premiums) Improvements in Agriculture within the Hundred of Salford are desired to meet at Mr. Pullen's, the Old Coffee House, in Manchester, on Wednesday, the 26th of this month, by Eleven o'clock in the Forenoon, in order to consider and fix upon the best and most likely Method of doing it. Dinner will be provided by Mr. Pullen's for such Gentlemen as intend to favour the above Scheme, and will be ready exactly at Two o'Clock.

A further meeting was held on 9th September and this was followed by a third on 1st October, when Col. Townley was elected as the inaugural President, Mr. Bayley, who had presided over the earlier gatherings, assuring those present of his own intention to be the most active member of the Committee. The finances were in the hands of a Mr. Newton, who with his brother ran a bookshop in part of the premises occupied by the Old Coffee House, and Mr. John Scholfield, described as a bookseller, of Rochdale. As Col. Townley was a former classics scholar of Cambridge University and Bayley contributed papers on agricultural and other subjects to a number of publications, there was quite a literary touch to the progenitors of the Royal Lancashire, and this found its way into the early notices, so often couched in the best prose and, in the case of those emanating from Col. Townley, often interspersed with passages from the classical writers.

Although Col. Townley's interests in agriculture were mainly those of the country squire with a deep-rooted passion for rural activities, Bayley brought something of the approach of the practical man, with a penchant for trying out new techniques. On his own estate at Hope Hall, near Eccles, a few miles west of Manchester, he was specially concerned with drainage problems and the use of manures. In this last connection, his work *Thoughts on the necessity and advantage of Care and Economy in Collecting and Preserving different substances for Manure*, first published in 1795, was not only a standard for many years, but has been said to have largely anticipated the

treatment of nightsoil carried out at a late date by the Manchester Health Committee. Apart from his agricultural pursuits, Bayley espoused the cause of slave abolition, was mainly instrumental in forming the forerunner of the Manchester Chamber of Commerce, was a founder of the Manchester Literary and Philosophical Society, a Fellow of the Royal Society, and a writer of papers on highway maintenance and management. His death came, at the comparatively early age of 57, in June, 1802.

In all, twenty-one premiums were awarded at the inaugural show held on 1st October, 1768, in St. Ann's Square, and these covered such things as reclamation work, cultivations, and manurial treatment, as well as root and cereal crops and cattle, which comprised two classes, bull and cow calves, the last being judged upon a raised platform. It is interesting to note that the president himself was the recipient of a silver medal in the section for owners of 'land not having less than 50 statute acres in the neatest order as to fences, gates, stiles, etc.' and the following year, Mr. Bayley took similar awards for the best crop of potatoes and the best cow calf.

Important as was the work of the early pioneers, whose contributions to Lancashire agriculture were dealt with by Mr. Edward Bohane, for many years secretary of the Royal Lancashire Society, in the organization's journals fifty years ago, there is not the slightest doubt that the family which has played a major role in the development over the last century is that of the Stanleys, whose titular head is the Earl of Derby. It is therefore particularly appropriate that the twentieth Earl should be this year's President.

It was, as already mentioned, the then Earl of Derby who played a big part in the amalgamation of the Manchester and Liverpool societies, having been patron of both for some years before, and his son, the then Lord Stanley, was the first President of the new combined organization and also held office again in 1855, 1856 and 1866. The fourteenth Earl was president when the centenary year of the foundation of the Salford Society was celebrated, and in 1874, the Earl's chief agent, Mr. George Hale, presided at the conference which brought about the further amalgamation with the Royal North Lancashire Agricultural Society and the fifteenth Earl was President in 1883, 1887, 1891, and 1892. The next holder of the title held office as President when the name was changed to the present style. When the Society established its headquarters in Preston in 1907 he performed the opening ceremony of Derby House, so named to commemorate the family's then long links with the oldest society of its kind in the land.

Today, the offices are on the showground at Blackpool. They will shortly become not only the place of administration for the annual show itself but for the zoological gardens and the indoor centre which can be used for covered exhibitions and equestrian events, and which form part of a gigantic plan being embarked upon at the outset of the third century of the Royal Lancashire Agricultural Society's existence.

Sydney Moorhouse

The Story of Bagots Park

R. H. Twinch R. J. M. Orrett

BAGOTS Park lies in one of the remoter parts of the English Midlands. Only ten miles to the north the foothills of the Pennines break the horizon and immediately to the east lie the gently undulating pasture lands which were once part of the Forest of Needwood. The most southerly section of the River Trent drains the area and beyond, still further to the south, the vanes and spires of Lichfield are visible. Abbots Bromley, only two miles distant, famous for its horn-dance, a direct link with Medieval England but dating from pre-Christian days, is the nearest village. Situated on an elevated plateau some 450-500 feet above sea level and sloping to the south, Bagots Park is over 700 acres in extent.

Historical background

At the time of the Norman Conquest the Bagot family were established in their manor at Bagots Bromley, a mile from Bagots Park. In the Domesday Survey the family was entered as taxable owners. They moved to nearby Blithfield in the 14th century. Throughout the centuries Bagots Park changed very little. In the late 16th century glass works were established in the Park and were worked for 50 years with timber being cut to make charcoal for the furnaces. About this time small parts of the land were enclosed but later these early enclosures were levelled and some springs and ditches were piped. About 50 acres known as the 'Plains' were ploughed in the Napoleonic and First World Wars. In the Second World War 120 acres were ploughed and reseeded and ditches were cleaned out. But by far the greater part of the Park was virgin land and the whole area was covered with bracken and ancient oak trees until the 1960s. Names such as Squitch Oak, Walking Stick Oak and Beggars Oak had been given to particularly fine specimens. It was said of the last named 200 years ago that its shade covered an acre of land, while the Walking Stick Oak still stands, 70 feet high to the first branch, a monument to its fallen brothers. A herd of goats roamed the Park. Their ancestors had been brought back to England by returning Crusaders and the herd had been given by King Richard II to Sir John Bagot. There was also an Heronry of 26 nests. This was the scene in 1964. In the next two years there were to be dramatic and spectacular changes.

Development programme

The story of the development began when the 6th Lord Bagot died and part of his Estate comprising a large area of forest let to the Forestry Commission, Bagots Park and a tenanted dairy farm were sold to Mr. and

Mrs. Brian Dale of Ludlow, well known as turkey breeders. Possession was completed in the autumn of 1964 by which time a Farm Manager, Mr. John Lewis, had been appointed. The first council of war was held at this time in the only house in existence in the Park, Squitch House, approached along a grass track when weather permitted and joining with the rough metalled track running east-west through the centre of the Park. The outlook from this place of continuous bracken and scrub and with great oaks stretching to the horizon in three directions was challenging. A programme of reclamation, drainage and cropping was decided upon.

Farm labour was a problem. The circumstances were difficult; an area large and isolated served only by a rough track and with only one dwelling house upon it was unlikely to attract regular skilled labour. Cottages would take time to build and in any case they could not overcome the problem of remoteness. The solution lay in the purchase of a fleet of mini-vans to mobilize prospective employees; so equipped men could travel easily from surrounding villages as far as ten miles away. Two men were engaged in the autumn of 1964. The labour force is now the farm manager and four men.

Early tasks

The first priority of work was to crop the area originally reclaimed during the Second World War, involving normal cultivations and a small amount of drainage. In addition a proportion of the less formidable rough grazing was to be tackled. Operations commenced immediately and continued through the winter of 1964/65. Contractors bulldozed out the stumps or blew out the bigger trees with explosives. Great fires of stacked stumps were made and the farm staff then cleared up what was left of the trees and ploughed the land. As a result of energetic work, 204 acres were sown with barley during the spring of 1965. At this point when other farmers could ease up and congratulate themselves that sowing was complete, the manager, contractor and employees alike turned their attention to further reclamation. Hundreds of trees had to be removed and the land cleared and ploughed. All through the summer of 1965 this task continued.

Other aspects in the creation of an agricultural holding out of virgin land had also to be considered at this time. A network of open ditches to collect the water from the successive drainage schemes laid in newly-cleared blocks of land had to be excavated by dragline. Tile drainage schemes had to be surveyed, planned and laid. Culverts wide and sturdy enough to take modern farm machinery had to be constructed. Mains electricity was brought to the Park. It was established that ample water could be provided from a borehole. A general purpose building 90 $\times$ 60 ft was erected in the centre of the land. A project as large and as involved as this required and obtained wholehearted support from the various technical branches of the Ministry of Agriculture, Fisheries and Food.

In 1966 the total acreage of cereals was 485. This figure reflected the rapid progress made in only eighteen months since the start of work and it exceeded the wildest aims of all concerned with the venture. Winter wheat yielded 33 cwt per acre and spring barley 31 cwt per acre. Varieties selected were Capelle and Champlein winter wheat and Rika and Mosane spring barley. The latter was chosen especially for its early maturing qualities, despite some risk from its poor mildew resistance, as sowing continued well into May. The total yield from all cereal crops was 760 tons and this was accommodated in the general purpose building.

Ploughing after clearance. Farm Manager Mr. R. J. Lewis on the left.

Technical problems

The technical problems encountered were interesting. The first, and probably the most important of all, was the need for huge quantities of lime. The soils in Bagots Park are mainly glacial in origin, predominantly medium-heavy textured and naturally short of lime. Where the solid geology reaches the surface in the form of Tea-Green Marl and Rhaetic Beds (the two uppermost formations of the Triassic System) the resulting soils are heavier textured and somewhat higher in natural lime content. Much of the land cropped in the first spring had been ploughed 20 years earlier and it was found that in these parts lime requirements were relatively low. This was fortunate and enabled barley to be sown without risk of failure, but, where the land was virgin pH values as low as 3·8 were recorded and lime requirements of 6 tons initially, with more needed later, recommended. Soil analysis also indicated that phosphate levels were very low. Potash status on the other hand was fairly satisfactory. Any fertilizer application had to ensure the provision of 40-50 units of phosphate and there was a strong case for combine drilling it. In practice a complete fertilizer was drilled 'down the spout' with the seed.

Buildings and roads

The Squitch House, formerly a gamekeeper's cottage, was improved and is the residence of the farm manager. New houses for stockmen will be built in due course. A general purpose building, 90 × 60 ft, was built early in 1965. This building had reinforced brick walls and was converted into a grain store for approximately 800 tons of grain. A lean-to, 90 × 35 ft, was built on the south side of this grain store. There is a current proposal to make this lean-to into a further grain store so that, if necessary, a thousand tons of grain can be stored on the floor. At present the grain store is equipped with two 25 h.p. axial flow electric fans, a central main duct and laterals for

floor drying. A further general purpose building, 90 × 60 ft, is now being built; all the buildings have been sited centrally. A three phase main supply of electricity has been brought to the farm buildings.

The first road to be improved was the access to Squitch House and land nearby, which, from being a rough track was made up into a hardcore road. A 6 in. concrete road, reinforced in part, 800 yards long was built in 1966 and this gave access to the farm buildings. It is now proposed to construct internal service hardcore roads approximately 3,200 yards long to serve the remainder of the land and, in the future, to extend the concrete road to the boundary of the Estate.

Fencing, drainage and water supply

Only short lengths of fencing have so far been erected and these are largely on an experimental basis. With the introduction of a sheep enterprise this autumn, some permanent fences are being installed which will enable the whole of the farm, with the help of movable fences, to be grazed in rotation. In all cases the high tensile wire fence is to be used with straining posts and droppers.

The Park was undrained to modern ideas. The whole of the area is gradually being underdrained with 6 in. and 4 in. mains and laterals at 66 ft centres, 36–48 in. deep, without permeable fill. In isolated pockets it has been necessary to put in additional drains. A borehole 210 ft deep has been sunk to supply water at the rate of 1,300 gallons per hour and this supply will be taken to the whole of the farm.

Capital costs over 710 acres

The Table below shows the capital costs which have been, are being, or will be carried out. The figure of £172 per acre can be compared with the current price of well-equipped land. Figures are net after grant.

Item	Completed	In progress	In the future	Total
	£	£	£	£
Purchase Price	46,000			46,000
Reclamation	11,000		1,000	12,000
Drainage	15,600		3,400	19,000
Buildings	9,700	3,000		12,700
Roads	3,100	3,300	5,400	11,800
Water supply		2,800		2,800
Fencing	800	4,000		4,800
Houses	2,700		10,500	13,200
	88,900	13,100	20,300	122,300

Future break crops and rotations

By the spring of 1967 the whole of the original Park was reclaimed and all but 70 acres sown to cereal crops. However, plans are in hand for the gradual introduction in 1968/70 of a regular acreage of short-term leys, and 60 acres of corn was undersown this year. The reasons for such a decision are as follows:

1. Because of the heavy and late working tendencies of most of the land it is considered important to maintain organic matters as far as possible and so prevent loss of 'workability'.
2. Continuous spring barley on the scale envisaged would mean too high a labour demand at sowing and harvest peaks. Even with resort to outside contractors it is clear that such cropping does not represent the most efficient use of the labour resource.
3. Local experience indicates that perennial weed grasses soon get out of hand under continuous cereal cropping, and proper control by rotavation and spraying is a gamble on this type of land under the late harvesting conditions prevailing.

By 1970 it is proposed, therefore, to work the total area in 7 × 100 acre blocks and in the following rotation:

Winter Wheat, Winter Wheat, Spring barley, Spring barley, Spring barley (U/S), Ley, Ley.

Utilization of the grass break will be by intensive sheep and fat lamb production.

Unique experience

Those of us who have been privileged to watch and, in some small way, to help this reclamation and have seen the modern arable farm evolve from the ancient Deer Park have known that we were taking part in something that was unique. But catching up on history is not enough; a project like this cannot stand still, it must go forward. After the technical and financial success of what has already been achieved the future can be faced with confidence.

This article has been jointly contributed by: **R. H. Twinch, F.L.A.S., A.R.I.C.S.** of the Agricultural Land Service who is Divisional Land Commissioner for Cheshire and Staffordshire and **R. J. M. Orrett, N.D.A., M.R.A.C.,** of the National Agricultural Advisory Service who is Agricultural Adviser for the Uttoxeter District.

Vegetable Production in the Pacific States of the U.S.A.

T. Laflin

This article describes some of the things that the author saw during his visit to the Pacific States of the U.S.A., in July/August, 1966, when he attended the International Horticultural Congress at the University of Maryland.

In making comparisons between production and marketing practices in the Pacific States and in Great Britain, it is important to remember several basic differences. In the western United States, production is carried on in latitudes between 33° and 48° N., whilst in England the bulk of production is between latitudes 50° and 54°N. The summer temperature, generally, is much higher, making such crops as tomatoes, lima beans and gherkins important outdoor vegetable crops and providing a more favourable climate than we have here for such crops as dwarf and climbing Phaseolus beans. There is also a wide range of climate in the area, so that crops such as lettuce can be produced in the open in an ideal environment all the year round. This has resulted in concentrated production of a crop for a specific time of year in the most favourable localities. The product is then shipped, often a three or four day journey, to the consuming centres. This has made it necessary to provide conditions during distribution which will ensure that the product reaches the consumer in good condition. Perishable vegetables, such as lettuces, were usually fresher and often less battered after five days, with high ambient temperatures, than they are in some English shops a day after cutting.

Land and labour

The attitude to land use is generally different from our own. Although in parts of California, now one of the most densely populated states in the Union, the competition for land for urban development is as severe as in this country, in many places there is still plenty of room. Reduction in production costs rather than high yields appears to be the aim and output per man more important than output per acre. Water is very important. Few crops are grown without irrigation and, in California, many large water conservation and transportation schemes have been necessary to give an adequate supply for all purposes. Even so, in some areas demand is exceeding supply and competition for water is severe.

Availability of labour for seasonal work appeared to vary in different places. In some areas of California large numbers of Mexican workers were still employed on harvesting operations and other work. Much of the pack-


Furrow irrigation in the Salinas Valley of California

house work was done by women. In the more thinly populated areas, such as much of Oregon, it was difficult to find enough people at busy seasons. There is much active interest in machinery development, but progress in this field appears to be at the same stage as in the United Kingdom.

Monoculture, growing the same crop on the same land for many years in succession, was frequently done. Such lack of rotation with crops like brassicas and onions would be disastrous in Britain, but I could find no reason why it was less serious in U.S.A.

In California, large scale vegetable production is carried on in the large river valleys of the San Joachin and Sacramento rivers between the coast and Sierra Nevada and north-western mountain ranges and in smaller valleys in the coast range like Salinas. Water supply schemes from the Colorado River have made other areas, notably the Imperial valley, important winter vegetable producing districts.

Marketing lettuce

The Salinas valley is a flat alluvial valley about 125 miles long and 8 miles wide between two ridges of the coast range. It has a Mediterranean type climate and growing summer vegetables for harvesting between April and October is the main agricultural activity. Lettuce, celery, cauliflowers, and carrots are important crops. Most of the land is leased by growers and the rent of the best land may be as high as $250 a year, although this is not general. Most of the growers are in a big way of business and about 80 companies grow 90 per cent of the Salinas vegetables. All row crops are irrigated with furrow irrigation from a header trench. Most of the water supply is controlled by Monterey county. This irrigation method imposes a ridge and furrow culture, with all row crops planted on the ridges, which are standard 40 in. centres, irrespective of crop. Small crops, such as lettuce, are drilled two rows on a ridge; larger plants, like cauliflowers are seeded one row per ridge. All crops are direct drilled, usually in a continuous row. There is interest in spaced seeding and the most popular type of drill, or

planter as the Americans call it, is the British Stanhay belt drill, but high soil temperatures and crusting problems, affecting germination, make thicker seeding more popular. Much of the setting out of lettuce crops is still done manually. A lot of the pesticide and herbicide applications are done by contractors. Harvesting is seldom fully mechanized. Much of the packing and preparation for market is done centrally, under cover, but field packing is employed by some growers. For example, one crop of lettuce was being handled by piecework by a gang of 37 Mexicans. Two people assembled and mechanically stapled cardboard cartons on a lorry, two laid them out in the field. There were 15 cutters, 7 packers, 7 people closing and stapling packed cartons and 4 placing the packed cartons in rows ready for the pick-up truck. The output of the gang was about 500 cartons, each of 24 lettuces, per hour. In another case, lettuces were cut into bulk bins and the packing operations done in a shed. The bin bottoms were spring loaded so that the bottom sank lower as more lettuces were put in. No lettuce fell far even when starting to fill a fresh bin. After packing the lettuces were cooled in a vacuum tunnel, about 25 minutes being a sufficient time to reduce the temperature of the lettuce from 65° to 34°, and put into refrigerated wagons for transport. I saw a prototype selective lettuce harvesting machine, but there were still difficulties in its use to be overcome.

Brussels sprouts

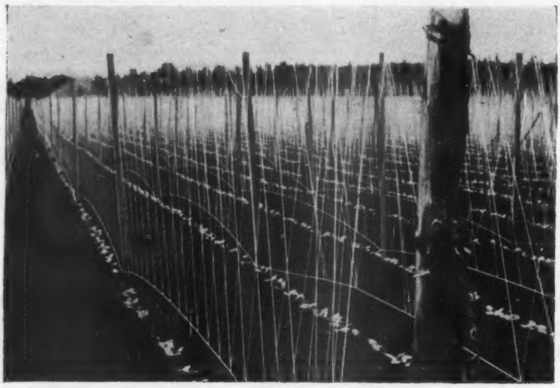
The inland summer temperature in California is too high for Brussels sprouts and production of this crop is limited to the coastal area around Santa Cruz and Half Moon Bay, about 5,500 acres in total. About 70 per cent of the sprouts are quick frozen; the rest are sold fresh, mostly at the end of the season. A number of growers have their own strains and grow their own seed. Apart from this Jade Cross is almost exclusively grown. Culture is similar to that in Britain, except that irrigation is essential. The coastal fields are undulating and rotary sprinklers are used to apply the water. The development of mechanical harvesters is along similar lines and at about the same stage as our own. With good conditions for picking, the stripping units are mostly trailer-mounted for operation in the field.

Asparagus

The San Joachin-Sacramento delta which lies west of Stockton is the main asparagus producing area. More than half the asparagus is covered and cut white, the rest being allowed to emerge and is cut green. About two-thirds of the production is processed, the rest sold fresh. Single-row ridge culture is the usual method, with variable spacing, but 6 ft × 8 in. is a common planting pattern. Whilst in the eastern United States, in New Jersey, the approach to mechanical harvesting of asparagus has been selective cutting, the Californians have built a complete harvester which makes a number of harvests over the season, cutting everything as it goes. This has reduced yield to a variable extent, but apparently the yields are still high enough to make it worth while. As with the lettuce harvester, there are still some problems to solve, but development is well advanced. Normal yields in San Joachin county are about 3,000 lb per acre from established beds, with beds lasting about ten years.

French beans

In Oregon, much of the vegetable growing is done in the Willamette valley, between the coast and Cascade mountain ranges. French beans for processing are an important crop; both bush and climbing types are grown. Climbing Blue Lakes beans are normally spaced at 5 ft between rows and supported on strings. Supporting posts are erected first and then both wire-work and strings are put up together, using a machine which feeds out the top and bottom wires at the same time that it winds twine over and under them. Behind the machine, men staple the horizontal wires in position, stretching the vertical strings taut as they do so.



Blue Lake beans in Oregon, after stringing by machine

Bulb onions

Lake Labish is an old lake bed of about 1,200 acres of peat soil which was drained about 80 years ago. Today it is the main bulb onion growing area in the west, where most growers specialize on this one crop. A golden globe onion of a variety named Oregon Yellow Globe Danvers is grown in 12-16 inch rows. Seed is sown at about 2½ lb per acre, C.D.A.A. seems to work well as a herbicide on peat with the weeds which are common in this area, and potassium cyanate is also used. Some growers had an ingenious weeding implement comprised essentially of a triangular frame, with stout wire fingers 9 in. long 3 in. apart standing out from it. These slender fingers were set horizontally and it was said to be very effective. Elevator diggers were commomly used for lifting; bulbs were then left in the field for 10-14 days, then picked up with a chain lift and elevated into bulk bins holding about half a ton of onions. The bulbs were stored in the bins, often in open fronted sheds. Another area of bulb onion production is in the extreme east of Oregon, in the Snake River valley around Ontario. Here they grow mainly the mild Spanish types.

Extensive and intensive

The largest area of peas for processing in the States is on either side of the Snake River in Walla Walla county, Washington and Umatilla and Union

counties, Oregon. During my visit in August, the season was finished. Most of the peas are drilled early, whilst the ground is still moist and harvested with mobile viners. The area above the main river is an extensive plateau, cut up into undulating hilly country by small streams, many of which were dry in August. The cropping of these hill slopes appeared to be peas, wheat and fallow and much of the land carried only one crop in two years. This was partly due to Government control of the wheat acreage and the payment of a subsidy for forgoing part of the wheat acreage allocation. With such low output, farms were big, few being less than 2,000 acres. Some land was owned by the farmer, but much was rented. I was told that share-cropping in some form was a common form of renting land.

Not all growers in the western states farm in a big way. On the outskirts of Portland and round the towns south of this were some highly successful growers with between 20 and 100 acres of vegetables. On one holding of about 20 acres at Milwaukee the grower specialized in radishes, making successional sowings each week in early spring and at about 3 day intervals throughout the summer. The earliest crops matured in about 70 days from sowing, but in summer the crop was harvested about 30 days after sowing. About half an hour elapsed between pulling the last of one crop to drilling the next. Four crops were taken each year from most of the land, and five crops from some of it. Soil condition was maintained by mulching immediately after drilling with about 70 tons per acre of a mixture of poultry house deep litter and dry sawdust. This gave a layer of about half an inch of the material over the bed. Cabbage root fly was controlled with a diazinon spray on to the soil after drilling and irrigation was used. The aim was uniform daily marketings throughout the week, with a small, self-built cold store as an insurance.

Impressions gained during a short, intensive visit to any area tend to be somewhat unbalanced, as emphasis is placed on aspects of work in operation and the crops which are on the ground at the time of the visit. Nevertheless, a well-planned tour can give a good overall picture, and I am indebted to the members of the staffs of the Universities and the Extension Services in the states visited and to many growers for enabling me to see as much as I did.

T. Laflin, N.D.H., is the N.A.A.S. National Vegetable Specialist at the National Vegetable Research Station, Wellesbourne, Warwick. Before taking up this appointment in July, 1965, he had been Director of the Ministry's Experimental Horticulture Station at Luddington, Stratford-on-Avon, since 1958.

Cereal Rotations on the Chalk

The Problems in Wiltshire (1)

G. A. Dowse

THE acreage of cereals in Wiltshire is now some 248,000 acres out of a total arable acreage of 390,000. As in so many other chalkland areas, the acreage of spring barley continues to increase with longer cereal runs and shorter breaks. This gives rise to many problems and the Agricultural Executive Committee recently set up a Sub-Committee, under the Chairmanship of Mr. Trevor Cave of Everleigh, to make an extensive study of the matter. The gist of its findings are given in this and a succeeding article.

Proportions of cereals to other crops

The traditional ratio of 50 per cent cereals to 50 per cent grass in the county has latterly commonly been raised to 70:30 to increase profit. For farming on a short term basis, profitability is highest on continuous cereals. One knows too well though that short term farming is rarely wise. Fifteen years is perhaps a reasonable period to consider and for such a period there is no doubt that 70 cereals: 30 grass is a safer system than continuous corn in the light of present knowledge.

Many farmers have been happy, however, to keep certain fields on their farms in continuous spring barley for 7-10 years, or even more, without undue difficulties and with good profit returns; others have failed due to the problems discussed later. Undoubtedly certain parts of a farm can well fit into this continuous cereal system and especially the more distant and outlying parts, but there are very few farmers yet willing to change a complete farm over to continuous corn, although many would like to do so. Why do not the many follow the few then? The answer seems that the change-over would raise several problems such as increase in grass weeds, wild oats and take-all and even cereal root eelworm. These give rise to uncertainty in the farmer's mind as to whether, with the present state of technical knowledge, satisfactory answers to their control can be given.

Use of grass break for maximum profit

Reliance must still in the meantime then be placed on grass as the main break for cereals. It is felt that this grass break should be used in order of

profitability and depending on the individual farming system as follows:

(i) *Milk production.* This is of course commonplace on Wiltshire downland either based on buildings at the homestead or on the Hosier bail system. The latter ideally knits in with a high cereal acreage as the cows can circulate around the holding, are their own dung-cart, minimize labour requirements and enable good weed and disease control. Additionally, the gross margin of the rotation can be raised by an increase of the winter wheat acreage.

(ii) *Herbage seed production.* This is a 'natural' on the chalkland farms especially for ryegrasses, and it is directly complementary to cereal growing for machinery and has the added advantage of keeping the profit margin well up when the grass break cannot be for milk. It is here though that many farmers have much to learn in increasing their efficiency with the crop. Higher nitrogen, greater use of silage or grazing and especially greater proficiency at harvest, are all points needing more attention. The increasing use of dessicants is greatly improving harvest yields and is even re-opening the possibility of cocksfoot and timothy growing, which clash too much at the moment with the all-important cereal harvest.

(iii) *Use by sheep.* This comes third provided that intensive systems and good stockmanship are used and that the major problem of fencing can be cheaply overcome. Sheep need a greater measure of skill than is at present found and are only rarely successful at the moment.

(iv) *Hand-rearing of calves for beef or dairy replacement purposes.* Here there must be a proviso that there has to be a high standard of calf rearing.

(v) *Double-suckled beef.* The major difficulty of supply of calves must, however, be overcome, where an individual farmer cannot draft any calves for his own dairy enterprise.

It is not generally recommended that single-suckled beef, grass conservation as hay for sale off the holding or lucerne grown for sale as meal should be entertained due to lack of profitability.

Management for the grass break

The essential requirement for the grass break on the chalk is for intensification and better utilization. This necessitates additional fertilizers and better management to ensure economic success.

It is most important that the comparatively small quantity of nitrogenous fertilizer now being used on Wiltshire chalk grassland should be increased to a much larger amount. Phosphate and potash must also then likewise be increased. This increased fertilizer requirement applies equally to rearing beef, dairy replacement or double-suckling beef enterprises as much as to milk, herbage seed and sheep production.

Grass seeds mixtures

Generally a two-year mixture comprising 20 lb British certified S.22 Italian ryegrass and 10 lb S.23 perennial ryegrass per acre gives good results. A three-year timothy/meadow fescue mixture, using certified New Zealand mother white or S.100 white clover, also has an important place. Cocksfoot definitely has its place provided the farmer is master of this grass, is generous with nitrogen applications on it and then stocks it heavily. Meadow fescue/white clover should be included with it and this mixture is then found particularly useful on black puffy chalk fields.

Benefit from grass break

Benefit there is in the succeeding cereals, but it is impossible to place an actual cash figure upon this benefit. The latter depends directly on how well the grass break has been done. It must be well farmed and not just 'rested'. Well fertilized and well managed grass definitely gives increased yields in the following cereals and the benefit can last for several years. It is felt that the main benefit accrues from reduced disease in the following cereals and improved structure, which in turn depends upon the duration of the grass break. The ability to grow a second winter wheat crop at a higher profit than the alternative spring barley crop and the fact that less nitrogen is required for the first two cereal crops, thus giving a direct saving in fertilizer charges, are other important benefits. The grass break, however, gives very little benefit in wild oat control or in the control of ordinary arable weeds and these problems must be tackled during the cereal period.

Cropping order

Winter wheat should be taken as the first crop. The following barley crop should suffice with usually about 50 units total nitrogen per acre. This second crop could, however, well be winter or spring wheat in lieu of spring barley and this is certainly increasing in popularity. If the grassland is required well into its last winter for stock grazing, spring wheat should be the first choice, but economically October sown winter wheat would give a higher profit. Changes in stocking techniques and especially the increased in-wintering of dairy herds is leading to less winter grass grazing.

Black puffy land

Winter wheat on this land is not recommended, but spring wheat is possible. Three years of continuous cereals on black puffy land is often the longest possible period. Yields can, however, fall off alarmingly after a third barley crop.

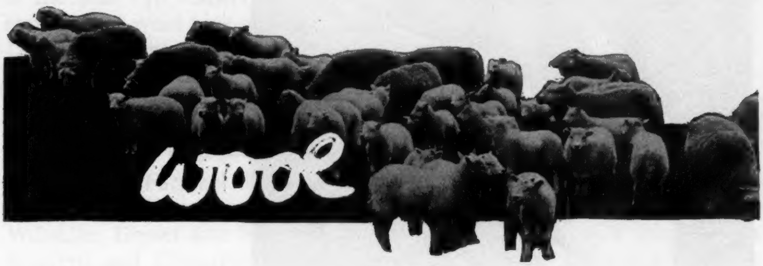
Annual spraying with a 2 lb/acre copper oxychloride (preferably in the colloidal form) at the 5-leaf stage in 20 gallons of water and with a wetter is essential to sustain crop yields. After 3–4 years of such spraying, due to the residual value of the copper, annual applications can be reduced to 1 lb copper oxychloride. Recent N.A.A.S. trial work has shown that a broadcast application of 40–50 lb per acre copper sulphate crystals can also be used and may have a residual effect for up to ten years. Spraying in the year of application is, however, still necessary.

A good alternative to cattle on this black puffy land is intensively stocked and managed sheep (at least four ewes per acre) rotationally grazed on one-year leys.

(Another article on this subject will appear in a future issue of *Agriculture*.)

This article has been contributed by G. A. Dowse, B.Sc. (Agric.), who is Deputy County Agricultural Adviser for the National Agricultural Advisory Service in Wiltshire.

Farmers Federation (Wool) Limited



F. E. Ellwood

How golden today is the Golden Fleece of mythology and of the Middle Ages? Whatever the answer is, many farmers on Exmoor and elsewhere depend on wool as one of their main sources of income. In moving eastwards to more kindly farming areas it is wool which tips the scales and enables the sheep unit on a farm to contribute to the viability of the whole enterprise.

The British Wool Marketing Board is the sole authority for buying all the fleece wool produced in the United Kingdom and it is auctioned for the Board at sales conducted by the Committee of London Wool Brokers. These sales are held at Exeter, London, Leicester, Bradford, Edinburgh and Belfast—a total of about 30 sales a year. The task of collecting some 81,000,000 lb of wool from 130,000 producers, from flocks of a few sheep or thousands, and presenting it in a saleable form meeting user's needs is immense. Aiding the Board in this work throughout the area, close on one hundred 'A' merchants are employed. The functions of the 'A' merchants are to send out wool containers, collect wool from farms, weigh, record and grade, pack, and finally dispatch on instructions from the Board.

A joint enterprise

For some time South Western Farmers Limited had collected wool from their members in East Devon and delivered it to South Western Wool Association for grading. South Western Wool Association is an organization formed many years ago by several Devon farmers' co-operatives and the Co-operative Wholesale Society, who have considerable interests in manufacture at Buckfastleigh. South Western Farmers Limited continues to handle wool for S.W.W.A. in this part of Devon. Early in 1964 Farmers Federation (Wool) Limited was formed as a joint enterprise by South Western Farmers Limited, Wiltshire Farmers Limited, and the British Wool Marketing Board, and were appointed 'A' merchants by the Wool Board. Three directors are appointed by South Western Farmers Limited, three by Wiltshire Farmers Limited, and two by the British Wool Marketing Board, making eight in all. The object was to form a producer owned unit to handle the wool previously collected and graded by four separate businesses

Grader examining a press packed bale of wool

operating in Somerset, Wiltshire, Dorset and Devon. To achieve this, the British Wool Marketing Board purchased the three businesses available and sold these, plus its depot at Wheddon Cross, Minehead, to the newly-formed Farmers Federation (Wool) Limited. In the first season, 1964, the use of the warehouse at Trowbridge was discontinued, and grading of wool was carried out at Bridgwater, Taunton and Wheddon Cross. Essential to the success of the venture were technical staff, and the highly experienced graders from each of four centres joined the new enterprise.

A central building

Meanwhile, plans were made for the future. The directors of Farmers Federation (Wool) Limited decided that South Western Farmers Limited should conduct the day-to-day affairs of the business, and that work would be concentrated at a new wool centre at Taunton. Successful wool grading centres were visited throughout the country, and the information obtained from each helped in deciding the size and layout of the new building, which was to be ready for the 1965 clip. A total area of 50,000 sq ft on two floors, using an elevator and mechanical handling wherever possible was planned. Lorries bringing wool from the producer unload under cover, and each wool sheet is individually weighed, and its weight and sheet number recorded. From the ground floor level weighing machine, the wool is conveyed to the first floor by elevator. Here it is graded at one of the three grading tables, the net weights of individual grades recorded, and the wool placed in bins to await hydraulic press packing. After packing, these bales which weigh some 400 lb, are delivered by chute to the ground floor, where they are stacked and await inspection and appraisement by the British Wool Marketing Board's Regional Officer. The Regional Officer directs which bales from each lot should be made available for inspection by buyers before sale days. After the wool is sold the duties of Farmers Federation (Wool) Limited are completed by loading lots on to the purchasers' transport.

In spite of every effort being made, the new building was not ready for occupation until the shearing season of 1965 was well under way, and, since the Bridgwater premises had been vacated, the old buildings at Taunton had to be used at the beginning of the season. However, these difficulties were overcome and grading was completed in the new building by the end

of the season. Grading of the 1966 clip proceeded promptly and efficiently and the new building has proved the necessity for careful thought and planning. The only adjustments that had to be made were to the size of some of the bins. (To readers not acquainted with wool grading centres, may I explain that wool bins are open fronted sections, some 10 feet square and 12 feet high, into which graded wool is collected.) The fact that there are some 180 grades of wool handled at this new depot in Taunton gives some idea of the task in hand.

A producers' organization

On behalf of Farmers Federation (Wool) Limited, South Western Farmers Limited and Wiltshire Farmers Limited collect wool from producers in Wiltshire, Dorset and Somerset, and from Devon east of a line through Bideford and Okehampton. Since Wiltshire Farmers Limited and South Western Farmers Limited are shareholders in Farmers Federation (Wool) Limited, it follows that membership of these Societies gives farmers a direct interest in the handling of their wool clip by Farmers Federation (Wool) Limited.

One of the main objectives of the British Wool Marketing Board is to minimize costs in marketing wool, since the costs are borne by the producer. Economies in use of transport, staff and buildings have to be effected continuously. Producer-owned organizations, of which Farmers Federation (Wool) Limited is one, give producers greater control in the handling of their product. Some 30 per cent of the wool in this country is now handled by farmer-owned societies.

How the producer can help

Each spring the British Wool Marketing Board send producers the wool price schedule for the year, with prices adjusted to the average guaranteed price decided at the annual price review. Included with this is a census form, requesting a return from each producer of the number of sheep and lambs to be shorn, and the month in which it is anticipated the wool will be ready for collection. Prompt completion and return of this form to the Board means that the merchant too can receive the information promptly, and thus will know the number of wool sheets required by the producer and can plan throughput at the depot.

Progress in the first three seasons

A team consisting of technical, clerical, and warehousing staff has been established working economically and efficiently together. Wool is collected and graded promptly, although with such a seasonal product some delay is inevitable in the peak of the season. Producers have confidence in the new organization, and this has been helped by visits to the centre, either to see clips graded, or on open days. Transport staff of the two Societies involved are now experienced in handling the rather unwieldly sheets of wool, and in loading them safely. All grading of the 1967 clip is being carried out at the Taunton Wool Centre.

The future

Key staff must be employed throughout the year and some profitable employment is required for them in the months between seasons. Further

lengthening of the grading season would require some part prepayment for clips before grading, but would bring economies in staffing by extending the grading period. Maximum use of premises, equipment and staff is essential for profitability, and it is hoped that opportunities will become available to increase the range of operations.

The competition from man-made fibres increases steadily, and to combat this, the quality and presentation of this natural fibre, wool, must be of the highest order. Much has been done already with breeding techniques to improve stock quality but little has been done to improve quality of wool. With the assistance of the technical officers of the British Wool Marketing Board, is this another function for Farmers Federation (Wool) Limited and other producer owned organizations handling wool? Meanwhile it has been demonstrated that a statutory marketing board and farmer co-operatives can usefully work together to serve producers.

F. E. Ellwood, N.D.P., is the Administrative Manager for South Western Farmers Ltd. Previous to taking up this appointment in 1964, he was General Sales Manager of this Society, which has a £6,000,000 turnover in Dorset, Somerset and Devon.

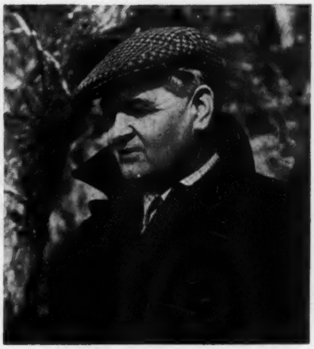
House of Agriculture Chambers for France

The important place agriculture holds in France, and in fact in Europe, was emphasized when the 'Maison des Chambres d'Agriculture' was officially opened on 6th June, 1967, by five State Ministers: Mr. George Pompidou, Prime Minister; Mr. Michel Debre, Minister of Finance; Mr. Edgar Faure, Minister of Agriculture (represented by Mr. Soupault); Mr. Raymond Marcellin, Minister of Plan and Territory; Mr. Francois Ortoli, Minister of Equipment and Logement; Mr. E. Roche, President of the Economic Council; Mr. Maurice Doublet, Prefect of Police.

Founded in 1927 by the Assembly of Presidents of Agriculture Chambers in a modest building in Rue d'Amsterdam (near the Gare St. Lazare Station), where all activities took place. With the ever-increasing development in all sections of agriculture in France and the expanding deliberations in connection with European agriculture, the Assembly was obliged to take over much larger premises. The newly-converted four-storey modern building at 9, Avenue George V and 8, Avenue Marceau in Paris was inaugurated.

British members of agricultural organizations interested in the future possibilities of France, and in fact Europe, may be interested to learn of the existence of this important agricultural centre of activity.

Intensive Sheep Production



W. M. R. Evans

Director, Trawscoed Experimental Husbandry Farm

WHEN one considers the various uses to which agricultural land is put and constructs a league table of the profitability of the various enterprises, it is clear that sheep production is the least profitable. The gross margin per acre of land devoted to sheep production rarely extends beyond £18. Yet there are huge tracts of farm land where for various reasons sheep production, alone or in conjunction with store cattle production, is the only form of production which can reasonably be considered. In such areas the fixed costs, at approximately £15 per acre, continue to rise, emphasizing the lack of profitability arising from this type of farming.

Of recent years the keystone to improved profitability in dairying has been the keeping of more dairy cows per given area of land. It is not surprising, therefore, that those farmers committed to sheep and store cattle production have tended to follow what would appear the most likely path to increased profitability, namely, intensification of both sheep and cattle. Many have pursued this line of approach. They have used higher levels of fertilizer, grown more grass and increased ewe numbers from 1½ to 4 ewes per acre and even to 5 ewes per acre. This intensification has generally led to an increase in the gross margin per acre devoted to sheep, but usually this increase has only been marginal, taking the gross margin to £20 per acre. In fact it would appear that even with the most skilled intensification of sheep it seems almost impossible to break through a ceiling figure of £20 gross margin per acre.

Disappointing results?

One is tempted to ask why intensification of sheep does not lead to a substantial improvement in profitability whilst in dairying intensification has invariably paid off. A significant result of intensifying sheep is the lowered value of the output per ewe. We found at Trawscoed E.H.F. that with 3 ewes

per acre the output per ewe was £12, at 4 ewes per acre £9 9*s*. and at 5 ewes per acre £8 13*s*. This mainly arises from the fact that at the lower density a higher proportion of the lambs are sold fat, many being sold in May and June when the price of lambs is still high. As density of ewes rises a lesser proportion of lambs are sold fat, and even those sold fat are not sold until later in the season when the price of lamb has dropped. At the higher density few if any lambs are sold fat, the bulk finding their way on to the store market. A proportion of these store lambs are frequently obviously unthrifty and fail to command a firm price. Therefore as intensification of sheep builds up the value of the commodity for sale decreases. Here the analogy with dairying falls down as a gallon of milk commands the same price whether it comes from a cow producing 800 gallons per year or one producing 1,000 per year. There is in fact no reduction in commodity value in dairying even though intensification usually leads to lower output per cow.

Influence of grazing systems

Accepting that intensification of sheep leads to less fat lambs and more store lambs one must justifiably ask why this should be, as intensification is usually accompanied by greater fertilizer usage and the growing of adequate grass.

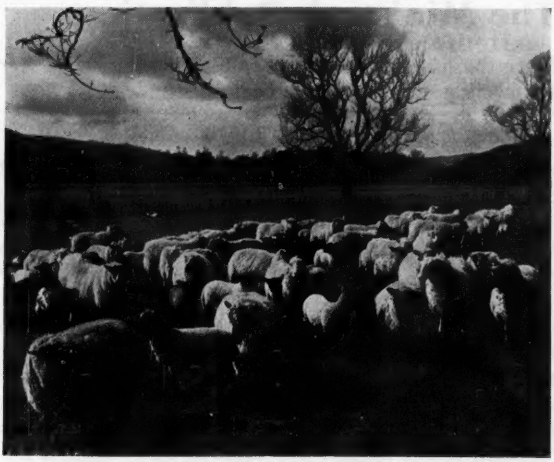
From 1959 to 1961 a trial was carried out at Boxworth, Drayton, Liscombe and Trawscoed E.H.Fs. with a view to measuring the influence of systems of grazing sheep during the summer months. At each of these farms set-stocking, rotational grazing plus forward creep and rotational grazing plus sideways creep were compared. In addition, at Boxworth and Drayton set-stocking plus sideways creep and rotational grazing were compared. Liscombe also made a comparison with rotational grazing. The pasture was dressed with 80 units of nitrogen per acre each season and stocked with ewes varying from 6 to 10 per acre. At these stocking rates the use of rotational grazing and creeps did not appear to influence the growth rate of lambs in the first 10–12 weeks of grazing. In this period the growth rate of the lambs was adequate, but beyond this point the growth curve declined generally. This pattern of growth may have been due to a natural decrease in growth rate, or it may have been due to sub-clinical worm infection, insufficient good quality grass or a reduced intake of grass by the lamb because, with increasing time, the pastures became soiled with faeces and urine. All the lambs in these trials had some level of parasitic infection but this was kept low by anthelmintics. This tended to indicate that over the grazing season it was the inability of the various methods of grazing to provide adequate nutrition after 12 weeks grazing that was mainly responsible for the decline in growth rate.

In later years higher levels of nitrogen fertilizer have been used than that referred to above, yet the pattern of lack of growth in lambs during July and August has persisted. Greater availability of pasture in these two months has not led to a change in the pattern of growth. This has tended to show that lack of growth in lambs after the 12-week stage seems to depend more on the digestibility of the grass in midsummer and the incidence of accumulated pollution of the pasture by faeces and urine. The accumulation of faeces on the pasture results in a restriction of the area of land which sheep will voluntarily graze, and even when grass keep is in abundance lambs will apparently only eat sufficient grass to maintain themselves.

Early weaning of lambs

If this is accepted as a reasonable hypothesis then this is sufficient reason for moving sheep on to fresh, untainted pastures towards the end of June. At this time ewes are making little contribution to the nutrition of the lambs through milk supply and are really in conflict with the lambs for the grass. This would be sufficient reason for weaning the lambs and moving them alone on the fresh pasture.

At Liscombe E.H.F. lambs have been weaned at 8, 12 and 16 weeks of age. Lambs weaned at 8 weeks have done less well by the time they reached 20 weeks of age than lambs weaned at 12 weeks. A further trial at Liscombe compared the growth of lambs weaned at 12 weeks and moved on to fresh pasture with others also weaned at this age and remaining on the pasture which they had grazed from early in the season. Figures appearing in the following table indicate the superior influence of clean untainted pasture on the well-being of the growing lamb.



Early lambs by Suffolk ram at Trawscoed E.H.F.

Treatment	*Mean liveweight change per lamb 12 to 20 weeks of age*
12-week wean, undosed, same pasture	— 2·3 lb
12-week wean, undosed, clean pasture	+17·2 lb
12-week wean, dosed, same pasture	+ 2·2 lb
12-week wean, dosed, clean pasture	+ 16·7 lb

Mean weight of lambs at 12 weeks 58·6 lb

Similar experience at Trawscoed supports the findings of this trial, namely that lambs grazed intensively need a change to fresh pasture at 12 weeks of age if they are to make reasonable growth at this age.

Fattening weaned lambs

Unfortunately with March born lambs the 12 week period in the life of a lamb is in late June and on most farms there is little fresh grass available at this time. Those farmers who are committed to conserving their grass as hay will not have after-math available, although silage-makers cutting in

late May will be better placed. Those who normally direct reseed land in April will also have fresh land available by mid-June. These two categories of farmers and those who might grow a crop of rape specifically for fattening lambs will be the only ones able to manage lambs in this way. In total this would not account for a big proportion of those anxious to finish lambs produced intensively. Another approach is obviously needed for those not placed in the position of those mentioned. If we realize that the pasture grazed by the sheep up to mid-June is not capable of providing more than maintenance after this time we could obtain the desired growth in lambs in July and August by providing a production ration in the form of concentrates.

Current trials at both Liscombe and Trawscoed E.H.Fs. are planned to establish alternative methods of managing lambs after the 12-week stage and to measure the economics of the various alternatives.

The Ministry's Publications

Since the list published in the July, 1967, issue of *Agriculture* (p. 331) the following publications have been issued:

MAJOR PUBLICATIONS

Bulletin No. 10. Calf Rearing (Revised) 4*s.* 6*d.* (by post 4*s.* 11*d.*)
Bulletin No. 136. Watercress Growing (Revised) 4*s.* 6*d.* (by post 4*s.* 11*d.*)
Bulletin No. 201. Hot Water Treatment of Plant Material (New) 5*s.* (by post 5*s.* 5*d.*)
Bulletin No. 202. Water for Irrigation (New) 9*s.* (by post 9*s.* 7*d.*)
Farm as a Business. Aids to Management 8. Dairying (Revised) 2*s.* 6*d.* (by post 2*s.* 11*d.*)
Farm Buildings Pocket Book (Revised) 3*s.* 6*d.* (by post 3*s.* 11*d.*)

MECHANIZATION LEAFLET

No. 13. Forage Harvesters (New) 1*s.* (by post 1*s.* 6*d.*)

FREE ISSUES

ADVISORY LEAFLETS

No. 69. Cabbage Caterpillars (Revised)
No. 150. Millepedes and Centipedes (Revised)
No. 263. Tomato Leaf Mould (Revised)
No. 284. Potato Cyst Eelworm (Revised)
No. 421. Cereal Cyst Eelworm (Revised)
No. 531. The Cider Apple Orchard (Revised)
No. 538. The Handling of Purchased Seed Potatoes (Revised)

SHORT TERM LEAFLET

No. 23. Chemical Weed Control in Strawberries

UNNUMBERED LEAFLETS

Small Farm Business Management Scheme–
Make More Money. Publicity Leaflet (New)
Farm Incomes, Costs and Management 1966–67 (New)
Horticultural Improvement Scheme. Grants for Growers (Revised)
The Safe Use of Poisonous Chemicals on the Farm. (APS/1)
Prevent Brucellosis—Free Calf Vaccination Service

The priced publications are obtainable from Government Bookshops (addresses on p. 402) or through any bookseller. Unpriced items are obtainable only from the Ministry (Publications), Tolcarne Drive, Pinner, Middlesex.

Bulk Storage of Potatoes Out of Doors

R. W. Austin

IN South Lincolnshire a system of storing potatoes in bulk out of doors has been developed by Mr. Ian Dickie, the Farm Manager for Messrs. J. H. Thompson (Farms) Ltd,. Holbeach Marsh. The outdoor store, often known as the Dickie Pie, has been developed and modified since 1960, both by Mr. Dickie and by nearby farmers, particularly Messrs. A. H. Worth. Now it is used not only here but in several other potato growing areas.

A large proportion of the potato crop is still stored out of doors, and this situation is likely to continue on many farms for some time to come. The high capital cost of buildings and the convenience of storing potatoes in the field, where they are grown, are two very pertinent factors influencing this trend. The traditional system of storage in small clamps, graves or pies—the name varying with the locality—has, however, extravagant labour demands, and this made Mr. Dickie and others seek an alternative.

The swing to using Dickie Pies has also been motivated by the rapid speed with which potatoes can be handled, not only on harvest day but also when the potatoes are being riddled. The Dickie Pie lends itself particularly well to complete mechanization of the potato crop. Yet another advantage is that the temperature and moisture regime of the stored potatoes can be controlled to preserve bloom, colour and weight loss by restricting ventilation to the cooler periods of the day.

Construction

The site needs to be well drained and level; if the pie is to be unloaded by a mechanical bucket, then the ground needs very careful grading beforehand. The walls should preferably be built in advance of lifting.

Straw bales and polythene alone are used in the construction of a Dickie Pie, with wooden ducts, top and bottom, to provide ventilation. Just a little more straw is required than for conventional clamping; for a 200-ton unit of potatoes, some 32 tons of straw is needed and 440 square yards of 300

CROSS SECTION

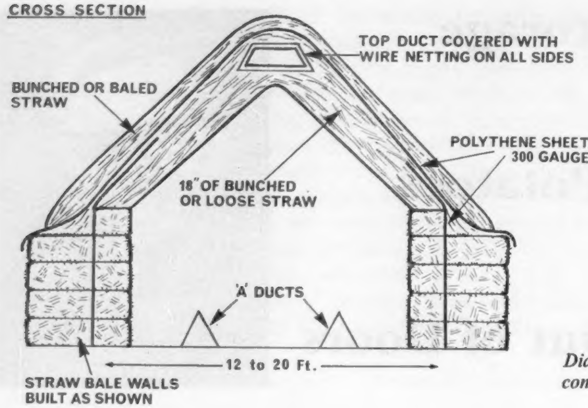


Diagram showing construction of a pie

gauge polythene new each year. 'A' ducts provide the bottom ventilation and a single large duct in the ridge allows top ventilation. A long reach elevator is required for filling the pie, which can reach right over the side wall so that no rutting occurs under the potatoes.

There are no hard and fast rules about the dimensions of a Dickie Pie, and in practice, widths of between 12 and 20 feet are being used; the reach of the elevator is often the limiting factor here. The maximum length usually used is about 30 yards, which gives a 200-ton store if the internal width of the walls is 17 feet.

The walls can be either four or five bales high and three bales thick. An inner single bale wall is built first so that an 8 ft polythene sheet can be sandwiched between this and the outer double wall to cut out draughts. This outer part of the wall will take a greater thrust if all the bales are placed butt end inwards.

Ventilation

Free convective air movements must be encouraged to minimize the risks of rotting losses. A single central floor duct for 12 ft wide pies is adequate, but two ducts are recommended for wider pies. The ducting goes right through the walls at each end and should be screened with bales to minimize wind influence and to make complete closure easy in frosty weather. These ducts should be blocked in the middle of their length to prevent through draughts. The standard recommendation for bottom ducting of 2 sq in. of cross-sectional area for each ton stored, appears to work satisfactorily. For example, for a 17 ft wide pie, 30 yards long, holding about 200 tons, two triangular 'A' ducts are needed with at least 15 inch sides if they are open at both ends.

There must be adequate ventilation at the ridge. A ridge duct, made of a light wooden frame, covered on all sides by wire netting, is the usual and most certain way of achieving this. It is placed under the polythene with 18 inches of loose straw between the potatoes and the duct. It is suggested that it should have at least 3 sq in. of cross-sectional area per ton of potatoes stored. The dimensions of this duct can be reduced by including chimneys at intervals along its length, as shown in the diagram. Arrangements need to be made to enable all the ducts to be closed in frosty conditions.

Filling and roofing

The potatoes are carried into place by the elevator over one of the side walls so that they are some 10 to 12 ft high at the ridge. These should then be covered by about 18 inches of loose straw or a double thickness of 'batts' or 'bunches'. The whole pie is then waterproofed by covering with a polythene sheet, which needs to be stretched from eave to eave over the ridge. This, in turn, is held in place by another layer of bunches or, alternatively, bales. Care should be taken to keep the middle well filled with potatoes, so that valleys in the polythene do not appear as the potatoes settle. This is particularly liable to occur against the side walls. Inspection points need to be created so that the tubers can be examined from time to time during the winter. Whenever the polythene has to be joined, a good overlap (at least 1 yard) should be left before the straw is replaced.

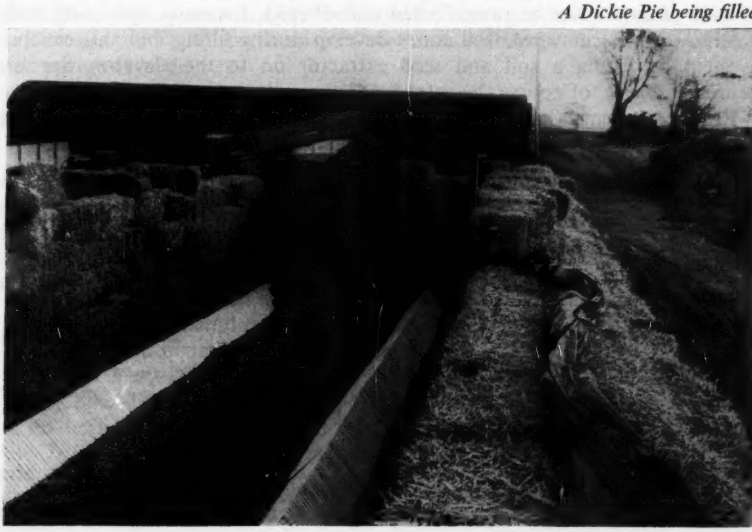
Temperature control

The same standards can be applied to Dickie Pies as to indoor bulk stores. Thermometers should be placed every 5 yards along the roof of the pie, set 2 ft down near the ridge, in polythene tubes, with the thermometer attached by a string to a cork at the top. Soon after completing a pie the temperature will rise naturally, and should be encouraged to do so by closing the bottom ducts, if necessary, for a short period so that there is a 10 to 14 day curing period. In a mild spell the temperature may even rise to 65 degrees F. After this the temperature will begin to fall and the ducts should be left open, except in frosty weather. If the temperatures remain high, then then bacterial rotting can be suspected and the pie should be examined closely.

Cost

The cost of the system depends largely on the value placed on the straw. If a nominal 28*s.* per ton is used, that is 6*d.* per bale, and the cost of the

A Dickie Pie being filled



Work in progress on a pie

elevator is included, depreciated over a 5-year-period, then the total cost for 200 tons of potatoes stored is 17*s*. 3*d*. per ton. On the same basis this compares with 6*s*. 6*d*. per ton for a traditional clamp, or 38*s*. for the cheapest indoor system, using new buildings. These costs do not include anything for labour as the value of the farm labour force doing alternative work, that is, their 'opportunity value', varies so much between farms.

Annual Costs per 200 tons stored

	Clamp	*Pie*	*Indoor Store (Romney Hut)*
	£	£	£
Straw @ 28*s*. per ton	36	45	15
Soiling @ 1*s*. per ft/run	30	–	–
Ducting—depreciation and interest	–	21	19
Polythene	–	16	–
Building—depreciation and interest	–	–	256
Elevator—depreciation and interest	–	91	91
Cost per ton stored	6*s*. 6*d*.	17*s*. 3*d*.	38*s*.

Problems

This system of storage, like any other, has its snags, and the principles of bulk storage must be remembered and obeyed. Excessive sprouting and deterioration occur where soil cones develop during filling, but this can be avoided by fitting a soil and seed extractor on to the elevator. Sprout depressants can, of course, be introduced through the bottom ducts.

Rats are a menace, when present, as they chew holes in the roof polythene, which will let in water. Rigorous control measures need to be adopted if they are a problem. Rutting alongside the pie can cause serious difficulties in wet weather if the tractors and trailers are running on soft ground. A hard road alongside is the ideal, and it helps to have a swinging receiving hopper on the elevator so that heavy trailers do not have to back in muddy conditions.

Losses have occasionally occurred in pies where rainwater has penetrated through the roof straw to the potatoes before the polythene sheets has been pulled over the roof. This is probably the greatest danger in the system and the roof polythene needs to be put in place with judicious speed.

The Dickie Pie has successfully stored potatoes through mild and severe winters on both heavy and light land farms. It has now been used on a large-scale for 5 years and is a proven system of potato storage.

The author of this article, R. W. Austin, B.Sc. (Agric.), joined the N.A.A.S. in 1959 and has been District Adviser for the Holbeach district of Lincolnshire since 1963.

Disposal of Farm Effluent

The Dairy Farm **A. J. Quick**

As in other fields of human activity, progress in the management of dairy herds leaves a number of urgent problems in its wake. Most noticeable are those concerned with the handling of manure and as stocking intensity increases and systems of housing and feeding change, the problems become more acute. Dairy farmers face the difficulty of disposing of the by-product of their milk production with insufficient knowledge of the effect of heavy dressings of slurry on soil structures and plant growth. In addition, the system of disposal must satisfy statutory requirements designed to safeguard public health and amenities and it should be planned to comply with the recommendations for controlling the spread of animal diseases.

Three-point approach

Although at the moment there is no single universal solution the problem can be tackled on each and every farm using the same approach. First, by applying certain well-tried principles of materials handling, secondly, by identifying on each farm the main factors which will influence the choice of system, and finally by selecting the most suitable system from the alternatives available. These points can best be converted into practical terms by taking as an example an 80-cow herd in a wet area managed on a loose-housing and parlour system.

Quantities

What are the likely volumes of manure and other effluent to be handled each day during the winter? Each of the 80 cows will produce about 1½ cu. ft of manure daily. In addition to the solid material on the bedded area there will be about 500 gallons of slurry on the concrete yards. If the herd is cubicle housed the total quantity of 750 gallons will be in the form of slurry, plus a small amount of litter.

Rainfall

It has been estimated[1] that each 10 in. winter rainfall increases the slurry volume by 15 per cent. Thus, if our example had uncovered concrete yards in a 30 in. winter rainfall area there would be an additional 200 gallons of slurry. Rainwater shed from roofs at the rate of 20 gallons/cow/inch would add another 250 gallons.

[1]*Report on Slurry Removal from Cowyards and Sheds* N.A.A.S. 1962

Washing down and cooling

Swilling the collection yard and parlour after milking would raise the volume by a further 250-700 gallons depending on whether buckets of water or a power-hose were used. Cooling water, at the rate of 3 gallons for each gallon of milk produced would add a final 700 gallons to the total daily quantity.

Table 1

The average total daily volume for 80 cows

Source	*Quantity (gallons/day)*	
Slurry	600	
Rainwater	200	
Washing water	450	
Total effluent	1,250	(2 loads for 700 gallon tanker at 1 : 1 dilution)
Roof water	250	
Cooling water	750	
	2,250	(dilution suitable for organic irrigation)

Basic principles

These quantities clearly indicate some basic principles which can be applied immediately. To begin with, clean water from roofs and cooling systems should not be allowed to mix with the slurry unless dilution is required, or unless some of it can be first used for washing down and cattle drinking purposes. Next, in order to reduce volumes still further, consideration should be given to the possible economic justification for covering the concrete yards. Thirdly, any system should be carefully planned so that the minimum number of handlings are involved since these only increase the costs of milk production.

Factors affecting choice of system

Perhaps the most important factor affecting choice of system will be the type of land. On farms where wheeled transport can operate all winter, choice of system is not limited and costs of storage can usually be eliminated; but on land which prohibits the use of wheeled transport the choice virtually lies between total winter storage and some form of organic irrigation. Between these two extremes the system would include arrangements for partial winter storage and disposal by wheeled transport when possible.

Housing systems

The system of cow housing will affect the type of manure produced which in turn will decide the method of handling. Manure from bedded areas is stored *in situ* and can be handled by fore-end loader and spreader. Straw requirements can be reduced by 50 per cent[2] by designing rectangular bedded areas with access along one long side and by adding litter as required rather than a constant quantity at regular intervals. The slurry from cubicles can be dealt with by the same equipment used to clean the concrete yards and can be disposed of by spreader, vacuum tanker or organic irrigation. Adding large quantities of straw to absorb slurry creates work, increases cost and restricts choice of handling methods.

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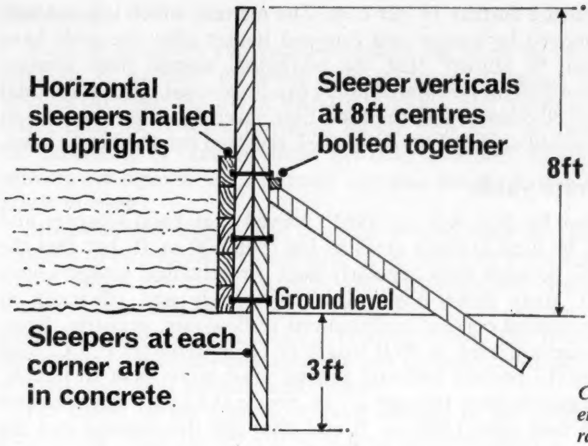
[2]*Report on Litter Usage*, N.A.A.S. 1961



Compound built entirely of railway sleepers

Concrete yards

The concrete yards used for feeding, etc., should not exceed 25 sq. ft/cow and by careful planning separate yards for exercise, feeding, collection and dispersal can be avoided. These yards will be more easily cleaned if they are rectangular in shape with tractor access at both ends. The cost of covering must be weighed against the additional cost of storage involved if they remain uncovered. It has been estimated[3] that the cost could be justified in areas where the winter rainfall exceeds 20 in. and the winter period 5 months, or, where both exceed 30 in. and 3½ months respectively.

Unit size and cost

As scale of enterprise and number of cows per man increase there is more justification for capital expenditure on mechanical equipment, not only to handle the additional quantities of manure involved but also to provide sufficient time for the more essential and productive tasks of milking and management. All the factors discussed above were used as the basis for a cost comparison 'ready-reckoner' produced by the N.A.A.S. Dairy Husbandry and Farm Management Advisers in the South-West Region. Three types of land, housing and herd size were classified and in each of the 27 permutations appropriate systems of manure handling were compared in terms of man-time and machine-time involved together with operating costs/month and additional annual fixed charges. (Figures used in Tables 2 and 3 are extracted from this information.)

Systems and methods of disposal

This subject can be suitably divided into two parts, the first dealing with collection and removal of manure to the storage point and the second with storage and disposal.

Elimination of the daily chore of collection and removal can be achieved by installing perforated floors but the cost will be about £15 per cow. In the experimental one-man 80-cow unit at the National Institute for Research in Dairying the floor area for the cows has been raised 3 ft 6 in. above ground level at a cost of £4 per cow. The grid-metal passageways between

rows of cubicles cost a further £8 per cow. The manure which accumulates underneath is removed by tractor and fore-end bucket after the grids have been lifted. It can be shown[1] that the additional annual fixed charges incurred by the provision of perforated floors can be covered by an additional 2 cows in a herd of 80 cows, whilst the total time saved from the elimination of daily cleaning would cover all the daily work involved for another 15 cows.

Cleaning concrete yards

An investigation by N.A.A.S. in 1962[3] proved that hand-scrapers and squeegees should be used to clean areas of less than 600 sq. ft, but that the job would need to be done more regularly than if mechanical scrapers were used. For bigger areas power-hoses clean as quickly and efficiently as tractor-scrapers provided correct combinations of flow-rate, pressure, hose-size and nozzle-size are used. A 36 ft length of $1\frac{1}{2}$ in. diameter P.V.C. hose with spiral wiring (to prevent kinking) proved most convenient to handle. A flow rate of 60 gallons/min. through a 1 in. nozzle at 15 p.s.i. gave the best cleaning rate of 3 man mins/1,000 sq. ft and although this method had the advantage over mechanical scrapers of achieving a washed surface, it increased the slurry volume by more than 80 per cent.

Table 2 gives the comparative costs for 80 cows of the two main systems:

Table 2

System	*Operating cost/month*		*Additional annual fixed charges*	
	£	*s.*	£	*s.*
Tractor-scrape yards	4	10	5	0
Power-hose yards	3	0	8	10

Loading

Where natural differences in ground levels exist they should be exploited to provide facilities for direct loading to a spreader or to the storage arrangements. Differences in levels can be created artificially by ramps which should have a gradient of about 1 in 8 and be designed to allow the slurry to be loaded either to the spreader or the store. Where the layout prohibits the use of a ramp, buckets and scoops attached to fore-end loaders make suitable alternatives. Although mechanical devices such as elevators and augers are two or three times as expensive they have a higher loading rate and release labour for other work.

Storage

The most expensive way of storing slurry is in below-ground tanks (at about 12*s*. per cu. ft). Above-ground silos with a small collecting tank cost less than half this amount but the cheapest method is above-ground storage compounds or shallow storage ponds lined with polythene, both of which cost about 1*s*. per cu. ft.

On a Wiltshire farm the total winter production from 140 cows self-feeding silage and housed in cubicles has been stored in a compound built entirely of railway sleepers. The effluent is tractor-scraped to a small sump from which it is mechanically elevated into the compound measuring 36 yd by 16 yd but only about 4 ft deep (see diagram on p. 385). At a convenient time, a section of the sleeper wall is removed and the semi-solid effluent removed by tractor-scoop.

[3]Quick, A. J. *The Slurry Chore*, Agriculture, December, 1963

Disposal

Manure spreaders and vacuum tankers are likely to be the most popular methods of disposal for some time to come. Although organic irrigation systems eliminate the use of wheeled transport and reduce storage and labour costs, their use is often restricted by the proximity of dwelling houses and the possibility of 'runoff' from wet land in winter. In addition, the job of moving the pipes is not a popular one and anti-frost precautions need to be taken in winter.

Self-contained storage and disposal systems such as oxidation ponds are unlikely to be completely successful in this country but so-called stabilization ponds, which rely on part aerobic and part anaerobic breakdown of organic matter, could well be the most promising future possibility but again the proximity of dwellings may be a limiting factor. The frequency of periodic de-sludging would depend upon the rate of breakdown but the job is one for a contractor with suitable equipment.

The costs* of the four most likely systems in our example of an 80-cow herd on wet land are compared in the following tables:

Table 3

System	*Operating cost per month* £	*s.*	*Additional annual fixed charges* £	*s.*
Tractor-scrape effluent via ramp to above-ground storage compound. Empty *annually* with fore-loader and spreader.	12	10	116	10
Tractor-scrape effluent to below-ground tank. Empty *annually* with elevator to spreader.	7	0	384	10
Power-hose effluent to below-ground tank. Empty *weekly* with vacuum tanker from roadways through irrigation pipes.	14	0	191	0
Power-hose or flush effluent to below-ground tank. Empty *weekly* by organic irrigation.	3	10	267	10

*Average figures for straw yards and cubicle housing. These costs are additional to those given in Table 2.

In America, one or two farms with herds of 1,000 cows have installed manure drying plants. The establishment of large herds in this country either by co-operation or amalgamation could result in this method being a practicable possibility but, as in America, success is dependent upon creating and maintaining a market for the dried material.

The author of this article, **A. J. Quick, N.D.D.,** is Dairy Husbandry Adviser in the South-Western Region of the National Agricultural Advisory Service. He was awarded a Kellogg Fellowship to visit the U.S.A. in 1964 for the study of cow management, housing and milking.

Farm Buildings Research
—a point of view

P. C. Girdlestone **Farm Buildings Association**

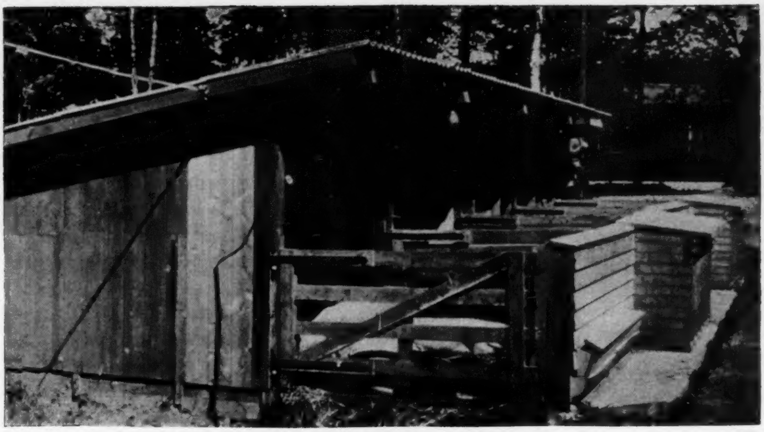
One of the big difficulties in any research into a subject like farm buildings is balancing the relative value of the technical optimum with the economic considerations. One must bring economics into account.

Accountancy

Economics require accountancy. The method of accounting is a very difficult and intricate problem. A simple example of how difficult this can be in other fields shows how two different methods of accountancy affected the production of similar parts in two big motor car factories in this country. One firm had a method of accountancy under which their steel presses were charged at so much an hour for every hour they ran. Therefore, they had eleven men feeding the press with sheets of steel and taking out formed motor car wings from the other side. This meant that the press was employed for the minimum time per motor car wing. The second firm charged the cost of the press as a percentage added to the labour involved. The answer was to employ only three men. This meant that parts of the motor car came out more slowly than at the first firm but so long as the press was able to cope with the requirements this was quite satisfactory. The two accounting systems had produced two quite different answers and both firms were completely satisfied that their system of working was the most economical and produced the cheapest motor car. The important thing, therefore, is to make sure that in assessing any farm building project one does arrive at the correct method of accountancy before producing answers in terms of economics.

Management

The question of management is, of course, of prime importance. One can have the most perfect farm building and the management cannot cope with it or, on the other hand, management is so good that it will overcome every difficulty put in its way. Any research or experiments that are carried out to find the value of a development must, therefore, have a parallel unit which can be used as the control. This concept is, of course, well known and quite common; in fact, research without it is almost useless. This does not, however, take into account the varying degrees of management. One might



Open piggery, Agricultural College, Norway

have in an experimental establishment superb management which would enable one to produce quite different answers to the practical ones which may arise on a farm where the time given by the farmer to studying economics is not very great. Possibly one should run trials on the control of some new development at high and low levels of management.

Without prejudice to the findings of the Brambell Committee I would like to quote as an example the problem of sweat-box pigs. Without doubt the pigs kept by Mr. Jordan in Northern Ireland are healthy, very cheaply housed and altogether highly economic from the point of view of the return to the farmer. There have, however, been many people who have tried to copy this method and have failed. Is this because Mr. Jordan has superb management on his farms? Is the Northern Ireland climate a prerequisite? Is the prime skill of his management really the adjustment of windows, so that when there is a humid south-west breeze the windows are wider open than when there is a north-east dry wind? Could this not be automated? The management of this function would then cease to be a problem. Management is a very big factor in a decision as to the type of building required but possibly some of this need for skill can be eliminated by automation. It is, therefore, inadvisable to limit farm building research to the building itself. One has to know what management is required and is available and the extent to which skill can be eliminated by automation.

Environmental temperature

There is a theory that a variable temperature stimulates children. Does it stimulate growth? Are we wrong to keep growing animals in a constant temperature? Do they eat less food and are they therefore more economical in a constant environment? It was very interesting to note that at a research station in Norway the conversion factor of some pigs kept outside in straw-filled pens with open houses nearly equalled that of pigs kept in an adjoining environmental house under the same management.* The Norwegians did not say much about this at the time, but it is very interesting and raises the

*A report has just come through on this, entitled, ***Norwegian Experiments on various types of housing for slaughter pigs***, by Hans Kraggerud.

question whether the fluctuating temperature was advantageous or whether the air conditions in the environmental house were not satisfactory because of high humidity, CO_2, H_2S and NH_3 level or for some other completely unknown factor which has not yet been considered.

Calves

Is it true that in this country the optimum environmental temperature for calves is 60°F up to 3 weeks and that they can then be hardened off if kept free of draughts and wet? Is this applicable to the whole country, including north-east Scotland? At the Conference organized by the Royal Agricultural Society of England and the Country Landowners' Association in November, 1965, at Kenilworth, Dr. Blaxter, the Director of the Rowett Institute discussed the climatic requirements for optimum economic production and he gave figures (*Farm Buildings Association Journal*, 1966). From this it would appear that after 21 days there seems to be little reason why one should endeavour to keep beef animals in environmentally-controlled atmospheres. The figures given in this table are possibly incomplete and it would, therefore, be of considerable value if this field could be greatly extended and the full statistics given, as it is only by knowing the facts that one can design appropriate buildings where required. It may be true to say that one does not require any buildings for beef animals from six weeks of age and upwards except possibly an open-fronted shed into which they can withdraw in particularly inclement weather.

Ventilation

What are the true criteria for ventilation? (See *Farm Buildings Association Journal* 1965). The differences of opinion arising between the Dutch work and the British work is sufficiently significant to warrant much further examination. Ventilation is, of course, of vital importance from the point of view of design. Very often the heat lost in the ventilating air is as great or greater than the loss of heat through the walls and roof. It is no good insulating the roof and walls if one has to pass through very much more air than is necessary. How can the volume of air be reduced? Obviously the ideal would be to make every animal wear a mask connected to a pipe from outside so that it drew fresh air from outside through its mouth and then expelled it into the building where it was housed. Such a system would give it fresh air to live on and there would be the minimum of heat loss in the building. This, of course, is impossible but if one could divert the incoming air so that it passed round the head of the animal rather than generally dispersing it into the existing air space one could take advantage of the fact that animals normally do not sweat. I would therefore like to suggest that research should be carried out into Dr. Steenkamer's suggestion that if CO_2 rose above 1 per cent at calf head level the calf was subject to stress.

I have always thought that there is something very sound in the idea that the foulest and coldest air is at floor level and that this should be extracted rather than the warm air at the apex. I have seen examples of underslat extraction both in Norway and at the Lycett pig houses. This appears to be a simple problem which it should be possible to explore and once the answer is found, the ventilation problem is greatly simplified.

The importance of the gases in the atmosphere breathed by the animals is brought out by a report from P. I. Haartsen in Holland (*Farm buildings*,

Dung extractor fans

January/February, 1967). It is also very interesting to see the comment (*International Journal of Farm Building Research* published in July 1966) on the result of an experiment by Ray Griffin, J. R. O'Callaghan and W. J. Promersberger on a model house. Locating the exhaust ducts under the slatted floor of the dunging passage provided more adequate ventilation for this area. This arrangement appeared to give also the best airflow patterns and air mixing characteristics. These points, in addition to more adequate ventilation of the dunging area makes it a desirable system. The curious thing is, however, that the airflow pattern was different when the throughput varied from $3\frac{1}{3}$ to 10 air changes an hour. The real problem, of course, is what is an undesirable atmosphere? Everyone has experienced at some time or other the unpleasantness of a stuffy room. What is it that makes a room stuffy? What is the actual physical content of the air that makes it unpleasant? Is there too much CO_2? Is there a trace of CO? I do not think it is humidity, because one finds it is quite tolerable to live in a high humidity-high temperature such as one finds in the tropics. We humans do not seem to know what would be good even for us and therefore it is very difficult to decide what will be satisfactory for animals. Of course we cannot design ventilation properly until we know what is going to be satisfactory. It is possible that by experimenting with animals and ascertaining their tolerances and dislikes we may be able to answer the questions about humans as well.

Milk regulations

The Milk and Dairies Regulations state that no person shall use as a milking house, milk room or for the handling, processing or storage of milk, any building or part of a building, which is so situated or constructed as to give rise to the risk of contamination of the milk. Supposing something is proposed, however, which means a saving of £50 a year either in building cost or in handling or labour and that this involves a possibility of one lot of milk per month being sufficiently contaminated to need rejecting. Obviously one would say that this saving is not worth while. If, on the other hand, the risk of this occurring was more likely to be once in ten years should one than accept this risk and save the £50 a year for ten years? The

difficulty of deciding what the chances are of contamination occurring under any circumstances would be extremely difficult, but it does seem to me that some analysis of this sort should be attempted and that we should not blindly accept the basic principle that no risk of contamination can be accepted. There are, of course, in addition to the financial effect on the farmer, the hazards to human and animal health which add considerably to the complication of the calculation which should be made. I saw one dairy farm in Norway where the cows were actually milked on the slats over the dunging chamber. In this country such an idea would not be tolerated. Research would be very useful if it could indicate what experience has shown to be the risk of contamination arising under different circumstances.

Grain silos

We have gone a long way towards discovering what the pressures are on the walls of grain silos. There is one point, however, that requires further consideration. This is the effect of an increase of moisture to the grain in a bin. In an article in *International Journal of Farm Building Research*, July, 1966, the author points out that an increase of 4 per cent in the average moisture content of grain in a store has been found by American workers to produce more than a six-fold increase in lateral pressures. It would appear that this is to be anticipated in a bin with non-elastic sides. However, if a bin is made of sheet metal panels like Crittall or Conder, or if it is made of a wire mesh with a lining of sisalkraft or Butyl, as the grain expands the sides will give and the lateral pressure will not increase to the same extent. If, however, the walls of the bin are made of reinforced concrete or some highly rigid form, then the pressure exerted increases six-fold as suggested and the walls of the bin crack. Moisture will then seep into the grain which will expand more the next time until the walls finally collapse.

Do we know what the position is if we take a circular corrugated steel bin and fill it with grain and allow the moisture content to rise by, say, 4 per cent. We will obviously cause the grain to expand but will that be more than the extensibility of the steel? Research into this might not be so urgent but it would be of value in the long term. We must, of course, remember that if the grain does become damp it can exert this tremendous overload.

Farm effluent

Every farmer is becoming increasingly conscious that he has got to make some arrangements for disposing of his farm effluent. He can try and get some good out of it by putting it on the land where it is hoped that its manurial value would be greater than the cost of getting it out to the fields, or one can digest it in a tank and collect the gas evolved which can then be used as a source of power. Alternatively, he must get rid of it as cheaply as possible, e.g., down a mine or into a lagoon. Although various figures have been stated from time to time it is not often that one sees a true comparison of the cost of each method. It may be that the manurial system is not economically feasible when one cannot get out on to the land during wet weather, but it would be of great value if there were a clear statement of the relative merits of these methods of disposal and an estimate of the cost per cow or pig by each system.

It is usually thought that there is so little value in the effluent that the best thing is to dispose of it as economically as possible. If this is true it should

therefore be worth while comparing various methods of disposing of the effluent, lagoons, settling ditches, Pasveer ditches, and so forth. The whole efficiency of a set of farm building can depend entirely on how one is going to dispose of the effluent. In this case it is very possible that what is required is very little pure research but much more collation of facts from various experiments which have been carried out in this country and overseas. The Dutch, for instance, have been experimenting with a Pasveer ditch with pigs for some time.

I have set out some of the research which I feel is necessary before we can really start designing efficient farm buildings. Once we have obtained the necessary data we can then start to design standard farm buildings and this standardization would reduce the cost to the farmer. Until we know what we require, however, it is useless to sit down and design standard buildings.

This article has been contributed by **P. C. Girdlestone, T.D., M.A.(Oxon), A.M.Inst.C.E.,** who was born in Adelaide, Australia, in 1902 and came to England in 1920 where he read Engineering at Oxford. He was at one time Works Manager at the Steel Works Constructional Department of Lysaghts, Bristol. During the 1939–45 War Mr. Girdlestone served in the Royal Engineers, after which he started as a consulting engineer and became an adviser on farm buildings arising from the design and development of an automatic cow tie and an in-churn milk-weighing device. He has been a Member of the Farm Buildings Association since its inception, was Chairman 1963–4 and appointed Secretary and Editor of the Journal in 1966.

The views expressed in this article are those of the author and not the Farm Buildings Association or the Ministry of Agriculture, Fisheries and Food.

Agricultural Engineering Symposium

THE Institution of Agricultural Engineers will hold its Agricultural Engineering Symposium at the National College of Agricultural Engineering, Silsoe, Bedford, from 11th to 14th September 1967, assembling on Monday evening and dispersing Thursday midday.

At this first event of its kind to be held in Britain nearly fifty papers will be given, ranging over a broad spectrum of agricultural engineering technology in the world of today.

Particulars regarding residential facilities may be obtained from the Honorary Secretary, The Institute of Agricultural Engineers, Penn Place, Rickmansworth, Herts.

2. Bedfordshire

A. L. Boyd

BEDFORDSHIRE, a county of nearly a quarter million acres of crops and grass, is often rightly associated with the growing of market garden crops. Yet by far the greater part of the county is devoted to farm crops and within its boundaries are to be found some noteworthy farming businesses. One such business is that which trades in the name of Messrs. Parrish Brothers Ltd., Manor Farm, Higham Gobion, the senior members of which are known to all their friends as Jack and Ken Parrish.

This is an attempt to condense into a short article the solid achievement of 38 years during which a business that commenced in a rented farm grew into the owner-occupation of 3,000 acres. In 1929 three brothers, Jack, Ken and Bob Parrish, started farming in succession to their father, when Sir Felix Cassel accepted them as tenants of a 500-acre chalkland farm just to the north of Luton (New Farm, Streatley) at a rent of 12*s*. 6*d*. per acre. This was the beginning of the period which agricultural historians describe as one of economic blizzard for farmers and landowners alike, and when a man's wage was 30*s*. 6*d*. per week.

The arable land was some 460 acres in extent and was worked on a rotation of fallow (sown with mustard) spring corn, spring or winter corn, one-year ley, winter wheat. Oats, both spring and winter sown, featured largely because a good local demand for chaffed oat straw at 45*s*.–50*s*. per ton on the farm raised the value of the crop above that of barley.

A flock of 300 ewes of mixed breeds was carried and lambs were sold fat off the ley aftermaths with some help from the cake bag. So depressingly low did the sheep trade become, however, that they decided to change over to poultry in 1931. Also in this year, brother Bob had the chance to take a farm in Buckinghamshire and withdrew from the partnership. The labour force was now the two remaining partners and one hired man. A single Fordson tractor and four horses provided the power, the tractor doing all the ploughing and the horses the drilling and other top work. The poultry flock consisted of 1,500 laying birds in semi-intensive houses on the permanent grassland, but after a few years this livestock enterprise was also discontinued because of poor returns and also there was more money to be made from growing cereals.

Thus in the very early 1930s these brothers took policy decisions of a kind common enough perhaps in the 1950s and 1960s but undoubtedly *avant-garde* at that time. Their objective was to expand cereal production and for this they sought more heavy land because they had found that such land grew fewer weeds and gave better yields; they also wanted large fields to economize in labour.

The introduction of the Wheat Act 1931 confirmed their view that there was more hope for cereal growing than for livestock enterprises. Until 1931

the treatment of agriculture by the State had been governed by the acceptance of Free Trade and *laissez-faire* as the guiding principles of commercial policy. The scheme of assistance for wheat was based on principles with which we are now familiar, i.e., a standard price and deficiency payments. In those days the guaranteed price was based on a standard price of 10*s*. per cwt; the funds, however, were raised from a duty on flour collected from millers and which was imposed equally on flour made from home-grown and imported wheat.

In 1933 they took the tenancy of a further 440 acres (Aubers Farm) at a rent of 13*s*. 6*d*. per acre. A more typical rotation now that they had some heavy land would be three corn crops after fallow followed by a one-year ley and then two more corn crops. Tractors took over and the horses were gradually dispensed with. The funds required to finance this expansion were provided by their local bank. Right from the start they have relied upon their bank to finance them. It is worth noting that from 1931 they have paid all farm bills at the end of each month, thereby taking advantage of all discounts.

By the outbreak of the war in 1939, despite the difficult economic condition of farming in the 1930s, the brothers felt that, by prudent management of their affairs, they were at last in a position to consider buying a farm. It had always been their intention to buy land if ever they had a chance to do so and thus to gain greater freedom of cropping and incentive to make improvements.

Their present residence, a heavy land unit of 540 acres was purchased in 1941 for about £30 per acre and they took full advantage of all Government grants to improve ditches, drainage and hedges and to convert all the ploughable grassland into arable. This has become standard procedure on all the units they have since bought; they have never minded buying a rough farm so long as it could be improved and it suited their pattern of farming. Further purchases followed in 1944, 1947, 1953, 1954, 1959 and 1962 until their total acreage reached 3,000 acres.

Now, some 80–85 per cent of the arable acreage grows corn, the break crops being potatoes (60 acres), Brussels sprouts (40 acres), tic beans (140 acres) with the balance in one-year leys, the hay from which is mainly sold. It is hoped to expand the bean acreage and to reduce the ley.

Most land work is now done by crawler tractors, wheeled tractors being used only for light cultivations. Two or three passes with the heavy cultivator—three have been acquired in the last year or two—have replaced ploughing on much of the land, which is found to lie much drier after their use. Combine seed and fertilizer corn drills are used throughout, the brothers being emphatic that fertilizers should be placed.

The labour force works out at one man per 140 acres. There are five large corn driers and bulk storage for the whole of the grain harvest. Livestock still plays a small part, 150 head of bullocks in all which are kept for grazing the unavoidable grass and are sold fat at 2–2½ years from yards in the winter.

Jack and Ken each have two sons all of whom are very keen on farming; three of the boys are married, live in the farmhouses of various farms and supervise their respective units. Jack and Ken turned the partnership into a private limited company in the early 1950s and their boys now hold shares in it. Meetings are frequently held to discuss and agree all matters affecting cropping or management that merit joint consideration.

FROM THE ALS

Temporary Buildings of Pole Construction

L. Wrathall *Agricultural Land Service, Wolverhampton*

In farming circles in recent years we have heard more and more about the need to avoid over capitalization in the form of fixed equipment. This has tended to draw attention to the merits of short life buildings where the discerning eye will discover that like the 'pre-fab', designed as a temporary home for many in the immediate post war years, these buildings can, in fact, have an extraordinary long life. Two such examples exist on one farm in the West Midlands, where two pole barns erected with farm labour have been in constant use for twelve years and still provide useful cover.

Since they were first erected these buildings have housed Irish store cattle, sows and their litters, turkeys and other poultry as well as farm implements at various times.

The buildings are 280 ft long, 40 ft wide and 7 ft high to the eaves. The framework consists of round timber posts, forest thinnings for purlins, etc., and the roof is covered with roofing felt, straw and chicken wire netting.

Refelting of the roofs was carried out in 1964. This was necessary because poor quality roofing felt was mistakenly used originally. When this was done some additional sealing with tar was carried out and this too has proved to be wrong as the tar has added little to the weatherproofing qualities of the roof and has reduced the flexibility of the felt, consequently increasing the risk of wind damage. Roofing is a simple procedure. It involves the laying of 2 in. mesh chicken wire up the rake of the roof, secured to the purlin by staples. Straw is then laid as a fill or packing as it is impracticable to strain the netting. It thus serves the dual purpose of giving an even surface to the roof line as well as providing a degree of insulation. Roofing felt is laid horizontally on top of the straw and is secured along the purlins by $1\frac{1}{2} \times \frac{3}{4}$ in. timber roofing battens. Over the years some of the straw has become friable and has dropped out through the wire mesh, particularly at the west end. It is thought that the prevailing west to south-west winds have contributed to this as there is very little loss of straw at the easterly end. However, despite these tribulations the buildings are still in the main quite weatherproof.

There has been some deterioration of the larch purlins probably due to there being too much sapwood in the thinnings used and many of these will now have to be replaced. Larch will not be used again. It is thought that Douglas Fir might be better. Also a few of the timber posts may need to be renewed, but these have, in fact, suffered very little from natural causes, most of the damage having been done by mechanical accident, when mucking-out. The feet of the posts are remarkably free from rot, due

A pole building constructed facing north

to the free draining nature of the soil and possibly to the fact that they were peeled at the butt end and creosoted before being fixed.

Care has to be exercised when mucking-out due to the low headroom especially near the eaves and on many sites it would be preferable to have well rammed and bluided hardcore for the floors in place of the existing earth as this has become rather rough in places. Cleaning out is no problem with a four-man, three tractor team, but prior to this any internal divisions have to be removed.

There are no walls, the buildings being fenced in with low corrugated iron sheets, laid on edge, with chicken wire over. As well as the timber posts, the original 18-gauge chicken wire throughout the buildings is in a remarkable condition for its age, and it is thought that this may well be due to the fact that fortunately the farm is 'up-wind' of the corrosive atmosphere of the nearby industrial Midlands.

The replacements which have been carried out over the twelve-year life have been assessed as follows (for each building):

6 Centre posts.
12 Other, intermediate posts.
14 Purlins.
14 Eaves pieces.
14 Rolls of pig netting (for walls).
New roofing felt.

The two most perishable items have proved to be the roofing felt and the larch purlins. Many of the purlins, in fact, have not been renewed owing to the difficulty of replacing them. If the work was done again better quality timber would undoubtedly be recommended for these.

Unfortunately no accurate building maintenance costs are available, but bearing in mind the comparatively small amount of maintenance already carried out and now necessary in order to ensure that the buildings remain in good condition, it cannot have been heavy. The farmer is thus able to look forward to being able to continue in partnership with the buildings for some years to come without having to provide for a heavy outlay.

The construction of this type of building is such that they can be erected by farm labour using readily available and inexpensive materials and need not be aesthetically displeasing to the eye. The experience of the buildings described in this article may encourage others to consider whether some of their own needs might be met in this way.

Books

The Control of Soil Fertility. G. W. COOKE. Crosby Lockwood and Son, 1967. 70*s*.

This is an outstanding, precisely written book embracing all aspects of soil fertility, which should find its way on to the desk of every adviser, lecturer, research worker and student interested in the subject. Farmers and general readers may also find stimulating sections within its covers. The stated object 'to present the scientific basis for the general principles of crop nutrition and to discuss the results of experiments with fertilizers and organic manures on crops in different farming systems' is satisfactorily achieved. The subject is dealt with in depth, stressing all facets of soil fertility problems including the impossibility of separation—something certain workers do not fully appreciate.

Accepting that aspects of soil fertility vary between countries, the basic principles nevertheless remain constant so the author has widened the content to include tropical problems.

The subject matter is covered in five main sections:

Part I describes the forms of nutrients in the soil and details the processes influencing their availability to crops. Major and micro nutrients are covered including micro nutrient toxicity problems from the use of fungicides, town wastes and sewage sludges.

Part II deals with the control of soil chemical fertility through the use of fertilizers and organic manures.

Part III is concerned with the plant nutrient cycles involving vegetation, the soil, the atmosphere and rainfall. An understanding of both aspects is essential for planning the maintenance of fertility.

Part IV covers the practical use of fertilizers and their effects in relation to nutrient reserves in the soil, crop rotations and climate. A valuable chapter discusses the use of soil and plant analysis in aiding decisions on the use of fertilizers.

Part V relates how some of the individual factors in soil fertility interact, influencing the yields attainable under different farming systems. Great stress is laid on the field experimental approach for investigating soil fertility problems and for developing new farming systems. Considerable space is given to the subject of soil productivity and the importance of soil structure in crop production.

Finally there is a forward looking discourse on 'New Farming for Old' towards the end of the volume, recognizing that continuous development is essential to progress. Each advance, however, unearths a new limiting factor which must be tackled by research.

The presentation of the book is strongly reminiscent of the Rothamsted Report; nevertheless the standard of printing and reproduction of diagrams and tables attains a high standard. Occasional good photographs could possibly have leavened the solid contents.

B.W.

Life from the Land. ROBERT TROW-SMITH. Longmans, Green, 1967. 42*s*.

The title suggests a social theme, the subtitle and final section 'a freehand chart of the main evolutionary stream of Western European ideas and practices'. But the text is essentially a history of farming in this country with substantial discussions of contemporary developments on the mainland. Yet such discrepancies are not very important, for it is soon clear that this book is primarily a means of enabling Mr. Trow-Smith to talk about the kind of agricultural history that interests him; and he does it very well.

In pleasant, conversational style, he takes us from the first sowing of crops and taming of animals via classical farming methods, the manors and reclamations of the Middle Ages, the coming of scientific farming and the agricultural revolution of the late eighteenth and early nineteenth centuries to the depression and recovery and the subsequent adaptations of European farming in the last age. Much of his story is familiar—he himself has helped to make it so—but he maintains our interest by his constant illustration of the general by the particular, and his lively, practical references to such topics as the survival of transhumance, the recreation by German geneticists of the aurochs, the origins of the Open Fields, medieval land-hunger, the comparative consequences of the 'mark'

system of much of Europe and the more individualist rural polity of Britain, and the manner in which the various countries reacted to the slump. Through it all runs the continuing themes of the interaction of the farmer and his environment and the pervading, remorseless effects of technical development.

The book is both enjoyable and stimulating, but it is not wholly satisfying. Its scope is wide and vague, it attempts too many subjects with too much enthusiasm and the result is neither balanced nor comprehensive. For example, the settlement of the German peasantry in the lands between the Elbe and the Oder, which was one of the most dramatic and important agrarian achievements of the Middle Ages, receives no more than a casual mention; there is little reference to the various rural risings which throw so much light on the conditions of their time, or to such interesting developments as the farm-and-forest systems of Sweden and elsewhere; and the impact of American technology in the last age surely deserves a paragraph or two, though the implication on page 216 is incorrect. The modern technique of storing damp grain in airtight silos originated in France, not the U.S.A.

The book can be recommended to readers who wonder if farming history would interest them and to academic historians anxious to improve their agricultural understanding. But it cannot be recommended without qualification to those who wish to learn in systematic fashion how and why the farming of Europe in general, and Britain in particular, developed as it did down the ages.

It is well illustrated and contains a brief reading list but no references.

N.H.

Some Economic Aspects of the Sheep Industry in the West of England. Report No. 5, 1960–61. R. R. JEFFREY. University of Bristol. 5*s*.

Economic reports are usually hard going for the layman, but this account of the sheep industry in the upland arable areas of the West Country could well be read with profit before making the last night-time visit to the lambing flock. Mr. Jeffrey's survey, conducted in 1960–61 covered some 22,000 breeding ewes on thirty-four Cotswold and seventeen Wiltshire Down farms. These farmers were primarily concerned with cereal growing, having up to half of their cultivatable land under corn. Current problems of continuous corn growing were avoided by the use of a ley break. Although dairying may be the most profitable way of utilizing grass it has no appeal for the larger farmers; sheep are thus the most acceptable stock for grazing the unavoidable by-products of corn growing. It is worth noting the relationship found on some farms between corn, sheep, kale and pheasants—clearly man cannot live on gross margins alone!

One of the fascinating facts emerging from this report is that few of these arable farmers are really interested in maximizing returns from the land devoted to sheep. This is surely a reflection on the profitability of barley production rather than the inability of sheep to make money. Bearing in mind the author's suggestion that there is neither the need nor the inclination to manage sheep intensively on these farms, one should not accept their level of returns as being anywhere near the upper limits possible. However, these upland areas will inevitably carry more sheep in the future and it is essential for someone (husbandry farms?) to devise simple but profitable systems of sheep production for them.

Flocks on the Cotswolds are based on the Clun and Kerry Hill breeds and rear a large proportion of their own replacements. Farmers on the Wiltshire Downs in 1961 preferred cross bred ewes such as the Scottish Halfbred and Masham, while the Suffolk was the predominant breed of ram in the two districts. Are there sound economic reasons for the choice of ewes or are personal preferences still the dominant influences on farming systems? The report reveals that cross bred ewes (though not necessarily on the same farms) reared an extra 10 per cent of lambs compared with pure-breds and this usually justified their higher initial cost. Average lamb mortality was around 10 per cent, but regardless of the facilities available at lambing time the only significant factor influencing lamb losses was the skill, experience and devotion of the shepherd to his flock. Mr. Jeffrey confirms the oft-forgotten fact that few flockmasters are able to exploit the present level of fertility in our existing sheep. I wonder whether this is due to inadequate training and reward for success on the shepherd's part or do we need to rethink our approach to sheep production.

Several criteria are available for measuring the success of the sheep enterprise, production and margin per ewe, per acre and per £100 of capital. Thus, number of lambs reared, value of lambs and time of marketing, stocking density and cost of winter feed all contribute to success or

failure. With these inputs and outputs the economist should be able to build econometric models for advising farmers on type of ewe, stocking rate, etc. Unfortunately, the vital human factor cannot be estimated and one is left with the question—what is successful management?

No apparent relationship was found between the capital value of the ewes and the level of production in representative flocks. Ewes purchased for £8 apiece produced £12 worth of lamb and wool in the best flocks but only £8 worth in the poorer flocks. High individual production from expensive ewes appeals to some farmers but the following example of a low cost system is well worth quoting. A flock of 700 draft Welsh Mountain ewes crossed with Southdown and Suffolk rams produced 728 lambs, all of which were sold fat off the ewes by the end of August at an average of 40 lb dead weight and £6 8*s*. 6*d*. per lamb. Total production, including wool, was £7 6*s*. per ewe or £24 per acre. The capital invested in the flock was only £3 10*s*. per ewe; production costs and depreciation were low enough to leave a margin of three guineas per ewe or £10 6*s*. per acre, while the margin of £90 per £100 capital was more than four times the average.

Producers in this country and especially New Zealand are told that the housewife requires light-weight carcasses. Mr. Jeffrey's conclusion 'that it is not so much what is produced that is of major importance as how efficiently production is undertaken' offers food for serious thought.

G.L.W.

Grass and Grasslands. IAN MOORE. Collins, 1966. 28*s*.

This volume is the 48th in the New Naturalist series and is the first to deal specifically with an agricultural crop. Significantly therefore the place of grassland in human destiny is appropriately acknowledged. The book has been addressed to the general reader and can do much to create an interest in grassland on the part of the town dweller. It could make him, as well as the average British farmer, recognize the important place that grassland has in our national life. It might also do much to bring town and country together and may even help the townsman to treat grass fields as crops sites and not as litter bins. The book will re-emphasize to the countryman that grass is a crop which must receive the attention it demands if it is to be productive.

There are nineteen short chapters which together deal with most aspects of grass and grassland. There are chapters on the types of grassland found in Britain, the breeding of grasses and on the production of herbage seeds. The best way to grow productive grass and how to convert it into animal product is dealt with in other chapters. Consideration is given to the pests and diseases of grass, to the weed flora of pastures and to health problems of grazing animals. There is a brief chapter dealing with the economic aspects of grassland farming and another which usefully reviews the subject of grasses used for lawns and other amenity purposes.

Whilst the book is for the general reader rather than for the specialist, there are some passages in it upon which the research agronomist might ponder. One of these (p. 92) reads as follows: 'There is still no satisfactory scientific basis for the use of fertilizers . . . nor is it possible from experimental evidence to offer general advice on the use of phosphates and potash'. If this be true then it is full time the grassland agronomist, soil chemist and indeed agricultural science in general sat up and took notice, with the view to correction of a completely unacceptable situation.

The volume is well illustrated with twenty-five delightful photographs including as frontispiece an acquatic subject in colour which has little relevance to the text. However, it is a most pleasing picture! In his preface the author indicates the type of reader he has in mind and includes school pupils, day release students in agriculture and those gaining practical experience before embarking upon more advanced courses. His book should prove extremely valuable in this respect and should further encourage readers of all ages to gain an interest in grassland farming, and may even whet the appetite for wider reading.

W.D.

Rural Settlement and Land Use. MICHAEL CHISHOLM. Hutchinson, 1966. Paperback 10*s*. 6*d*. (Hard cover 25*s*.)

The central theme of this book is distance and its effect on patterns of rural settlement, land use and farm organization. The author, currently lecturer in geography at the University of Bristol, demonstrates how 'economic distance' i.e., the cost of moving things, exerts a powerful effect on rural settlement and agriculture in both developed and developing countries. Apparently even so-called

primitive people living by 'shifting cultivation' concentrate most of their efforts in the immediate vicinity of their temporary homes. Agriculture's immense need for land and the wide dispersal of activity, which together distinguish it from other industries, make it very sensitive to changes in transport costs. The history of British agriculture since the 1870s illustrates this point clearly enough.

In chapter 2, Chisholm gives a full account of von Thünen's views on location and writes his essay around them. The author insists that the ideas expounded by von Thünen cannot be written off as of historical interest only but that they are 'a method of analysis which might be applied in any time or place'. Chisholm then proceeds, by partial analysis, to demonstrate that land nearest the farmstead is used more intensively, that consolidation of holdings is likely to lead to an increase in total farm output and that farm size is closely related to location. He also explains why New Zealand sends Britain Cheddar cheese and France Camembert.

As farming involves a great deal of lifting, fetching and carrying things (about 10 tons of things are moved about, per hectare, on British farms each year), it is not surprising to find concentration of production near markets, good roads, railways, or sea ports; nor is it difficult to understand why commodities, such as milk, are converted into cheese or butter if the 'economic distances' involved are relatively large.

The author examines the impact of technical change on patterns of rural settlement and farming, too, showing how such innovations as aerial application of fertilizer can extend the intensive margin. Reduction in the relative importance of agricultural rent, a phenomenon recently studied in both Britain and the United States, is shown to result partly from a decline in the importance of location of markets—due to technical advances.

This book is a good addition to the Hutchinson University Library although the writing is definitely ponderous.

J.A.M.

Concentrated Incomplete Fertilisers. MICHAEL BLAKE. Crosby Lockwood and Son, 1967. 20*s*.

The theme of this book, which has been written by a farmer for the benefit of other farmers, is the changes that may arise in the composition of soils and crops following the changes that have taken place in the composition, concentration and rate of use of modern NPK fertilizers. The author thinks that farmers should be made more generally aware of these changes and their possible consequences to the health of stock and the nutritive values of livestock products. Whether readers will be convinced by some of Mr. Blake's examples and arguments seems doubtful, but they will surely emerge with an uneasy feeling that all is not well and disaster could lie ahead.

The effect on soil fertility and the composition of crops from application of fertilizers containing NPK only, have been the subject of considerable activity by research workers and advisers for at least thirty years and the main results are appreciated and can be treated, even if they are not wholly understood.

Some consequences are of considerable benefit as for example the building up of P and K levels in soils where previously they were depleted. Others, and the ones that concern the author, are an increase in soil acidity and depletion, either in the short or long term, of other elements eventually leading to imbalance or deficiencies of essential elements in the plant.

Where and under what conditions these adverse effects become of importance is not disclosed. The writer uses extreme examples, quotations from letters and published writings which may or may not be relevant, and makes startling assumptions which do not follow from the evidence. It is a pity that he uses these techniques because there is some truth in much of what he says and a sound story could be written without them. He also throws doubt, quite wrongly, on the freedom of the N.A.A.S. to give sound technical advice because they are part of a government department.

The author makes a plea for more and better soil examination to assess nutrient levels and balances available to crops. Many advisers will agree with him on the need for this, though not always on the principles that he believes are important in defining conditions and arriving at methods of treatment. He also proposes the setting up of a permanent and independent technical committee drawn from government, farming, the sciences and industry 'to lay down standards of husbandry which conform with contemporary knowledge, and on which Price Reviews should be based', reflecting his unease that this is not already adequately done.

N.H.P.

Books Received

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The Milk Industry in a Developing Country. J. L. Davies. Department of Agricultural Economics, University of Nottingham, 1967. 2*s.* 6*d.*

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World Wide Survey of Fermentation Industries 1963. Butterworth. 3*s.*

Farm Guide 1967. Gleadthorpe Experimental Husbandry Farm. Ministry of Agriculture, Fisheries and Food. Copies free from the Farm Director, Welbeck Colliery Village, Mansfield, Nottinghamshire.

Electricity Research 1967. Copies from the Public Relations Department, Electricity Council, 30 Millbank, London S.W.1.

ACKNOWLEDGEMENT OF PHOTOGRAPHS

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Printed in England for Her Majesty's Stationery Office
by Hull Printers Limited, Willerby, Hull, Yorks.

(K101) 72-1-67-8


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